TELEPHONE ENGINEER

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SANITY IN TELEPHONE FINANCING

There is a distinct feeling in Independent telephone circles that the flurry caused by the activities of financial houses in the purchase and consolidation of telephone properties is passing and that little permanent damage to the industry will come of it. Some of the reputable financial concerns have already learned that there are conditions in the telephone industry that make it impossible to gauge results by what may be done in other industries. They have learned that the combination of small isolated units does not necessarily make for more economical operation as is the case in the electric power and light business, for instance, where transmission lines take the place of small, uneconomical central stations.

Such concerns are proceeding carefully in the telephone financing schemes that are placed before them. They have a reputation to maintain among their customers which they do not care to lose by participating in questionable promotions. If they have been misled by promoters, they are preparing to see the matter through even at some sacrifice to themselves.

The other class of promotion schemes which have no other object than the turn of a profitable dollar made from the sale of securities which are based on a capitalization of future prospects and little else, are not finding the going quite as easy as their sponsors had anticipated. State commissions seem to be on the alert to restrain, as far as their statutory powers permit, the issuing of securities on a basis which can only result in impaired service or rates increased to amounts which the public will not pay.

The option peddlers who have been active in taking options on properties which they expect to turn over at a profit without the investment of any real cash, have found that suckers are not biting well on the kind of bait they are using. Already a number of options have expired and some telephone owners who too hastily have given options which have not yet expired are breathing a little more freely in the hope that the date will pass without the option being exercised.

The early collapse of the unhealthy boom in telephone property will be hastened by the circulation of the statement issued by the United States Independent Telephone Association giving an analysis of the factors to be considered in studying financial statements of telephone companies. This is a concise, well reasoned discussion of the points that must be considered in investigating the financial status of a telephone company or the soundness of a proposed security issue. If the principles laid down in this statement are followed by investment bankers and local bankers purchasing securities for sale to their customers it is certain that few wild cat issues will find a wide market.

This statement deserves to be widely circulated in financial circles, and if this is done, it will do much to stabilize conditions in telephone finance. No company that is on a sound basis has anything to fear from its circulation and the way may even be shown to other companies who need improvement in their conditions. It may be illuminating to managers and boards of directors to submit their own affairs to measurement by the yard stick of this statement.

HOPE FOR RECORD CONVENTION

It scarcely seems necessary to do any urging to bring out a record attendance at the Convention of the United States Independent Telephone Association at Chicago beginning October 12th. All the signs point to a large gathering. It seems that times of unrest and change in the business are the most favorable for bringing out the crowd to telephone meetings. Some of the pioneers tell of the great and exciting conventions back in the days of the fight against the Bell and a few of them are a little sad because the fireworks of the earlier meetings have been missing in recent years.

The consolidations, mergers, sales and purchases of recent months have disturbed to some extent the even tenor of the way of Independent telephony and there will be many who attend to get a line on the direction which things are taking.. No doubt there will be some who will be disappointed to find that the Independent industry is moving along apparently little disturbed

by the unrest. By far the larger percentage of Independent companies that will be represented have little idea of a change in their status and are going ahead expanding their business and developing their properties as if nothing were happening.

It will be a good convention. There will be interesting programs and instructive exhibits. Old friends will meet again and renew acquaintances of former years. Those who attend will go home with new ideas for improvement of property and service and with renewed ambition to put them into effect. The convention will not save the Independent telephone industry because it is on too sound and solid a foundation to need saving in spite of the occasional disturbing winds that blow.

PUBLICITY IN TELEPHONE DIRECTORY LISTINGS

Telephone companies recently have been widely circularized by a manufacturing organization which is carrying on an active and aggressive campaign in the sale of certain equipment for production of household conveniences. This company apparently is very anxious that its local agents be listed in telephone directories under the trade names of its products as well as under the agents' own names. They also inquire if these trade names may be made classifications in the classified sections of the directory.

The California Independent Telephone Association, which has been quite active in working out directory problems, has considered this letter and has recommended to its member companies that the desired listings in the general subscriber list be given at the regular rate for extra listings or joint user service. In the classified directory, it is pointed out, the listings are not for the purpose of giving publicity to a commodity or a service and, therefore, listings of the trade names as separate classifications should not be permitted. Of course, there is no objection to the company or the agent presenting the desired trade names and the local telephone numbers as paid advertising in the directory.

The stand of the California Association seems to be a sensible one and one which can be recommended to telephone companies everywhere. The telephone directory is too valuable an advertising medium to be made a vehicle for free publicity for nationally advertised products.

ON READING TECHNICAL BOOKS

It may be assumed from the fact that authors set down on paper their thoughts and ideas and publishers print and bind the manuscripts into book form, that books are expected to be read. Whether it be brilliant or stupid, entertaining or soporific, instructive or recreative, each book will have its special circle of readers and each book, or at least each class of books, will have to be read in its own particular way. Some books may be read at a sitting with little or no mental effort on the part of the reader, while others must be read and digested, sentence by sentence, paragraph by paragraph and page by page.

A generation of readers accustomed to get its mental pabulum from the five-cent magazine of short stories and advertising does not find itself equipped with the power of mental concentration required to read a book of technical or semi-technical nature. Such books must be read after the fashion of reading a text book in arithmetic. The simpler facts and principles must be read and mastered before the reader can proceed to the more complex. The reader can not master the subject of compound interest unless he understands percentage and he can not understand percentage unless he is skilled in the simpler principles of multiplication and division. Pages and chapters can not be skipped as may be done in summer fiction.

The lack of understanding of this fact and the absence of a preceptor who says "so much shall ye read and be quizzed upon" accounts for the difficulty that many workers in technical industries find when they attempt to read books on their special line of work. After school days are over, practice in this type of reading is almost given up and few people acquire the faculty of acting as quizmasters to themselves. But neither the reading nor the self-examination are really difficult if the intelligent reader will proceed in a systematic manner.

If he will take one of the more elementary books on the special branch with which he is somewhat familiar due to daily contact in his work; will read the first paragraph or section and then say to himself, "What ideas has the author been trying to convey?"; then read the second section and ask the same questions, he will have made a start at mastering the art of this type of reading. At the end of the first chapter, with the aid of the table of contents he may review the subject matter, tie together the various ideas and subject himself to a mental review of the subject as far as he has read. A similar process may be followed through the second chapter and then the sequence and connection between the matter of the two chapters may be observed.

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Electromagnetism*

By F. J. DOMMERQUE
Fellow A. I. E. E.

29. Action of the Magnetic Field

It may appear that we enter deeper into the fundamental theory of electricity than would be necessary for a telephone man's requirements. This might have been true thirty or more years ago, when telephony was still an experiment; but since then telephony has grown into a science, more intricate than any of the electrical sciences, and all that is said here is only the most essential for the understanding of the modern developments in this particular art. It may, however, be repeated that it is not necessary for the reader to assimilate everything at the first reading. Rome has not been built in one day, neither has ever an education been acquired by reading a book once.

For telephonic transmission only weak currents are required, but they are of a comparatively high frequency, while in power transmission the current is large but the frequency is low and constant being generated by a dynamo. In telephonic transmission the frequencies vary, the number of vibrations being different for different tones. Hence it is necessary to first reduce the telephone transmission phenomena to tangible figures before any reliable and profitable calculations can be undertaken.

As telephone currents are alternating currents, their study involves the knowledge of physical laws which are fundamentally the same as for continuous or direct currents, but their application to alternating currents make conceptions more difficult and calculations more complicated. Therefore the study of the action of continuous current phenomena serves conveniently as a basis for the study of alternating current; consequently our discussion will proceed on a general basis not distinguishing specifically between the kinds of current, but will in the course of time be followed by a study of alternating currents essential for the comprehension of telephonic transmission.

If a current from a galvanic battery or other source of current passes through a wire, the region surrounding the wire will be found to possess properties similar to those possessed by the region around a magnet. If the wire is pushed through a piece of paper or cardboard and iron filings are sprinkled on the paper, they will arrange themselves in circles around the wire; but should the wire be laid down flat on the paper and the filings be sprinkled upon the paper, the iron particles would arrange themselves in lines at right angles to the wire. As the space surrounding the wire is a field of force the same as in the case of a magnet, the lines will form concentric circles about the wire in planes at right angles to its direction. A magnetized needle, when brought near to the wire carrying the current, will place itself lengthwise along the lines of force. Really the wire does not carry the current, the dielectric or insulating medium which envelopes the wire is the true seat of activity. Modern theory regards the dielectric as the vehicle of the energy conveyed by an electric current, the wire acting simply as a guide, but it is common usage to speak of the wire as carrying the current.

If the wire is bent to a circle the lines of force will curve round the wire and leave its plane in a direction perpendicular to it. Having now a determined field of force, mapped out by lines of force, an isolated north magnetic pole placed in the field will be impelled in a direction at right angles to the plane of the circle, and with a force proportional to the strength of the current circulating in the wire.

If a conductor carrying unit current is bent into a circle of unit radius, each unit of length will act upon unit magnetic pole placed at the center of the circle with unit force, upward or downward according to the direction of the current. Unit length is 1 centimeter; unit force is 1 dyne.

Taking the strength of the pole at the center of the circle as "m," the radius of the circle as "r," which may be unity or not, the strength of the current as "i" and the length of the conductor bent into a circle as "l," then for the entire circle the force $F = \frac{mi2\pi}{r}$, that is, the mechanical action on the pole of strength m at the center of the circle is $\frac{2\pi}{r}$ times the strength of the current carried by the conductor. For unit pole and unit radius $F = 2\pi i$.

In the chapter on magnetism it was found $H = \frac{F}{m}$, that is, the strength of the magnetic field is proportional directly to the mechanical force acting on a magnetic pole and inversely to the strength of the pole. Substituting the above value for F into this expression, we obtain $H = \frac{2\pi i}{r}$, that is, the strength of field at the center of a circular loop of wire is proportional directly to the current strength and inversely to the radius of the circle. If a straight conductor surrounded by a field of force, the lines of which are concentric circles in planes at right angles to the conductor, is held in the line of sight so that the current flows away from the observer, the lines will circle around the wire in clockwise direction. Assuming a wire passing vertically through a sheet of paper and the current flowing in it downward through the paper, then the lines of force will have their positive direction the same as the hands of a clock, while if the current is considered as flowing upward at right angles to the plane of the paper, the lines will circle in a counter clockwise direction.

If now the wire after passing downward through the paper is bent over and brought back through it so as to again intersect the paper perpendicularly, the lines of force will arrange themselves as represented in Fig. 22. The inner circle on the left, marked +, is

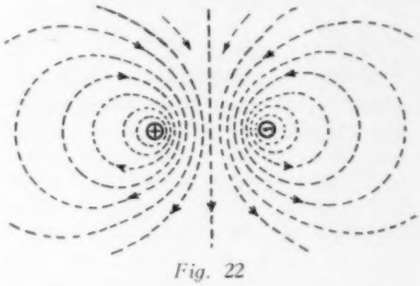


Fig. 22

the cross-section of the wire carrying the current downward, while the inner circle on the right, marked —, is the cross-section of the wire carrying it back and upward. In the former case the current is away from the observer and the lines of force encircle the conductor in clockwise direction, while in the latter case, where the current is toward the observer, the lines of force pass around in the opposite direction. As will be seen the lines of force between the conductors are all in the same direction and at right angles to the plane of the conductors. Midway between the conductors the lines are parallel and an isolated north pole placed there would be moved along the lines in the positive direction, that is, downward in the figure, with a force proportional to the field strength.

*Sixth article on Telephone Mathematics and Physics.

If the wire is bent around so as to form a circle the field strength at the circle would be $H = \frac{2\pi i}{r}$ ($2r$ being the distance between the cross-sections of the wire in the figure). A pole m would then be acted upon by a force $Hm = \frac{2\pi i}{r}$ m dynes.

In Fig. 23 is represented a uniform magnetic field, that is a field in which the lines of force are parallel, the strength being the same throughout, the arrow heads indicating the direction in which an isolated north pole would be impelled. If a magnet or magnetized

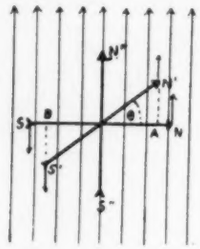


Fig. 23

needle SN is placed in the field so that its magnetic axis is at right angles to the lines of force, each pole will be acted upon by a force Hm (the field strength being H and the strength of the poles being m); the direction of the force acting on the north pole is the direction of the field, while the force acting on the south pole is in the opposite direction as indicated by the vertical and horizontal arrows. These two equal and opposite forces form a couple tending to turn the magnet, the magnitude of the tendency being the product of either force into the distance between their lines of action. As in the initial position, the length of the magnet is at right angles to the direction of the forces, this product reduces to Hm times the distance between poles. Denoting this distance, that is, the magnetic length of the magnet, by l, the movement of the force is equal to Hml. If there is no balancing force to check it, the needle will swing around until it places itself along the lines of the field in the position S″N″, where it will remain. If, however, the motion is checked after the needle has passed over the angle θ, when it is in the position S′N′, the force acting upon it tending to increase the deflection will be: force times arm = Hml cos θ.

As the needle remains at rest the force acting to restrain it will also be equal to Hml cos θ. There exists a magnetic field about the earth, as is evidenced by the alignment of a magnetic needle in a north and south direction (magnetically). If a circular lop of wire is placed in the magnetic meridian, that is, in a vertical plane along the lines of the earth's field, and if at the center of the loop a short magnetic needle is suspended, the latter will be turned in a north and south direction so as to lie in the plane of the loop. If a current is sent through the loop, it will set up a field in a manner similar to that shown in Fig. 22. The lines of this field being perpendicular to the plane of the loop will at the center of the loop be directed toward the east and toward the west (magnetically). In Fig. 24 the two black inner circles represent the wire intersecting the horizontal plane, the full drawn curves the lines of force of the field due to the current in the loop, and the dotted lines the direction of the earth's field. The latter is practically uniform, that is, it is made up of lines that are parallel and equidistant. The field of the current in the loop at the center of the loop is also uniform. If, then, a magnetic needle, whose length is small compared to the diameter of the ring, is placed in this region, it will always be acted upon by two fields, whose lines are mutually at right angles to each other, no matter how far around it may be turned. A needle supported on a pivot without friction will place itself initially, that is, when the loop does not

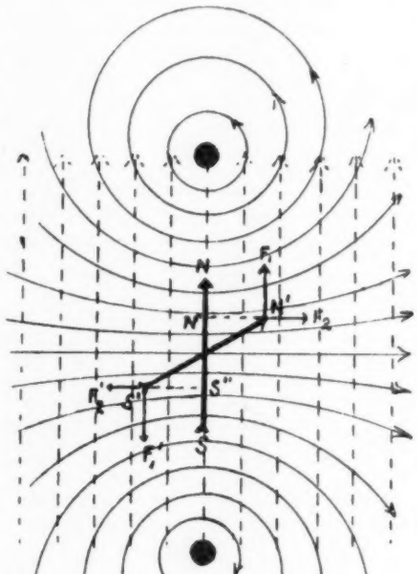


Fig. 24

carry any current, in the direction NS, Fig. 24. But as soon as a current is sent through the loop, the needle will be deflected by an angle θ.

If m is the strength of either pole of the magnetic needle, and H_e the strength of the earth's field, the force on either pole will be $H_e m$, acting in the directions N′F₁ and S′F′₁. The sum of the perpendiculars N′N″ and S′S″ will be the arm of the parallel forces N′F₁ and S′F′₁. As N′N″ = S′S″, the moment of the couple with which the earth's field tends to bring the needle back into the magnetic meridian is $H_e m \times 2N'N'' = H_e m \times 2N'O \sin\theta = H_e m \times l \sin\theta$, where l is the length of the needle. This is the "restoring" moment. The magnetic field set up by the current in the loop likewise acts upon the poles of the suspended magnet, producing forces on the north and south poles represented respectively by N′F′₂ and S′F′₂. If H is the strength of this field these forces are each equal to Hm. The perpendicular distance between their lines of action is $N''S'' = 2N''O = 2\frac{1}{2}\cos\theta$. The moment of the force tending to increase the deflection of the needle is then Hml cos θ.

As the needle remains at rest, the deflecting and restoring forces are equal, hence $Hml\cos\theta = H_e ml \sin\theta$ and $H = H_e \frac{\sin\theta}{\cos\theta} = H_e \tan\theta$, an expression for the strength of the field in terms of that of the earth. m and l have disappeared from the result, an indication that the deflection of the needle does not depend on its length or the strength of its poles, as these factors enter equally into the expressions for deflecting and restoring forces. A change in the magnetization of the needle, therefore, causes no error in measurement.

If the wire were given n turns wound so close that the mean radius r would not differ essentially from either the maximum or minimum, and if the length of the coil is not great, the field at its center will be n times that at the center of a single turn. In this case $H = \frac{2\pi ni}{r}$. Combining this expression with that above for H we obtain $\frac{2\pi ni}{r} = H_e \tan\theta$, whence $i = \frac{H_e}{\frac{2\pi n}{r}} \tan\theta$, an expression for the current in known terms, as H_e and r can be measured and tan θ computed from the observed value of the deflection. A coil so arranged for measuring currents is called a "*tangent galvanometer.*" The constant $\frac{2\pi n}{r}$ is called the *true constant* of the galvanometer, as it depends upon the construction of the instrument only.

The equation $H = \frac{2\pi ni}{r}$ shows that this constant is the strength of the field at the center of the coil produced by unit

current in that coil. Denoting it by G gives $i = \frac{H_o}{G} \tan \theta$. The ratio $\frac{H_o}{G}$ is sometimes written as K and denominated the *working constant* of the galvanometer. In the equation $i = K \tan \theta$, if the current is so great that $\tan \theta = 1$, that is, if $\theta = 45$, then $i = K$. But i is current, therefore K is current, which means that K, the working constant of the instrument, is numerically equal to that current which will produce a deflection of 45°.

Galvanometers are important instruments in telephonic work.

The expression $H = \frac{2\pi i}{r}$ for the strength of the field at the center of the loop of radius r gives the strength of the current $i = \frac{Hr}{2\pi}$. The dimensions of H are $C^{-\frac{1}{2}}G^{\frac{1}{2}}S^{-1}$, while those of r are simply C. Hence the dimensions of i are $C^{-\frac{1}{2}}G^{\frac{1}{2}}S^{-1} \times C = C^{\frac{1}{2}}G^{\frac{1}{2}}S^{-1}$.

30. The C. G. S. Electromagnetic Systems.

When discussing Electromotive Force, Current and Capacity in the previous article we defined the current as the rate of transference of electrification over a conductor. The dimensions of that current were $I = C^{\frac{3}{2}}G^{\frac{1}{2}}S^{-2}$. These dimensions are not the same as the dimensions for the current i just deduced, but if the latter value is multiplied by the amount CS^{-1} the former value is obtained. In paragraph 5 of the first article it was found that CS^{-1} were the dimensions of velocity.

The explanation is that there are two kinds of C. G. S. systems of electrical units, the C. G. S. electrostatic and the C. G. S. electro-magnetic system. Both systems have been used; of the two the electro-magnetic system is the more practical one.

As mentioned above, the current strength measured electrostatically equals the current strength measured electromagnetically multiplied by a velocity.

In the previous article we also determined the dimensions of potential difference, that is, of electromotive force as $C^{\frac{1}{2}}G^{\frac{1}{2}}S^{-1}$, which are of the electrostatic system. Since the dimensions of H, l and v are $C^{-\frac{1}{2}}G^{\frac{1}{2}}S^{-1}$, C and CS^{-1} respectively, the dimensions of the e. m. f. $E = H\ l\ v$ in the electromagnetic system are $C^{\frac{3}{2}}G^{\frac{1}{2}}S^{-2}$. Thus an electromotive force measured electrostatically equals an electromotive force measured electromagnetically divided by a velocity.

The dimensions of a resistance in the electrostatic system were found in the previous article as $C^{-1}S$, which is the reciprocal of the velocity. As by Ohm's law the current is proportional directly to the potential difference (that is the e. m. f.) and inversely to the resistance, the resistance is found by dividing the e. m. f. by the current. The dimensions of e. m. f. in the electromagnetic system are $C^{\frac{3}{2}}G^{\frac{1}{2}}S^{-2}$; of this value is divided by the dimensions of the current in the electromagnetic system, which is $C^{\frac{1}{2}}G^{\frac{1}{2}}S^{-1}$, we obtain $\frac{C^{\frac{3}{2}}G^{\frac{1}{2}}S^{-2}}{C^{\frac{1}{2}}G^{\frac{1}{2}}S^{-1}} = CS^{-1}$. If we divide CS^{-1} by C^2S^{-2} (which is the square of CS^{-1}), we obtain $C^{-1}S$ as the dimensions of the resistance in the electromagnetic system. Thus a resistance measured electrostatically equals a resistance measured electromagnetically divided by the square of a velocity.

The dimension of capacity in the electrostatic system were simply C, that is, centimeter. In the electromagnetic system the dimensions of capacity are equal to the quantity of electrification divided by the difference of potential or equal to current times time $\frac{\text{e. m. f.}}{}$, which is equal to $\frac{C^{\frac{1}{2}}G^{\frac{1}{2}}S^{-1} \times S}{C^{\frac{3}{2}}G^{\frac{1}{2}}S^{-2}} = C^{-1}S^2$. If we multiply $C^{-1}S^2$ by C^2S^{-2}, the square of CS^{-1}, we obtain C; therefore, a capacity measured electrostatically equals a capacity measured electromagnetically multiplied by the square of a velocity.

As the electromagnetic system of dimensions is so important, a table of the absolute units of the electromagnetic system of measurement is here appended. In addition it is thought helpful to also add a table of comparison between the absolute electrostatic and electromagnetic system.

TABLE 1.—ABSOLUTE UNITS OF ELECTROMAGNETC SYSTEM OF MEASUREMENT.

1. Unit of magnetic pole strength or intensity..	$m = C^{\frac{3}{2}}G^{\frac{1}{2}}S^{-1}$
2. Unit of magnetic field strength	$H = C^{-\frac{1}{2}}G^{\frac{1}{2}}S^{-1}$
3. Unit of electric current	$I = C^{\frac{1}{2}}G^{\frac{1}{2}}S^{-1}$
4. Unit of quantity of electricity	$Q = C^{\frac{1}{2}}G^{\frac{1}{2}}$
5. Unit of electromotive force	$E = C^{\frac{3}{2}}G^{\frac{1}{2}}S^{-2}$
6. Unit of resistance....	$R = CS^{-1}$
7. Unit of capacity.....	$C = C^{-1}S^2$
8. Unit of work.....	$W = C^2GS^{-2}$
9. Unit of inductance...	$L = C$

TABLE 2.—COMPARISON BETWEEN ABSOLUTE ELECTROSTATIC AND ELECTROMAGNETIC SYSTEM.

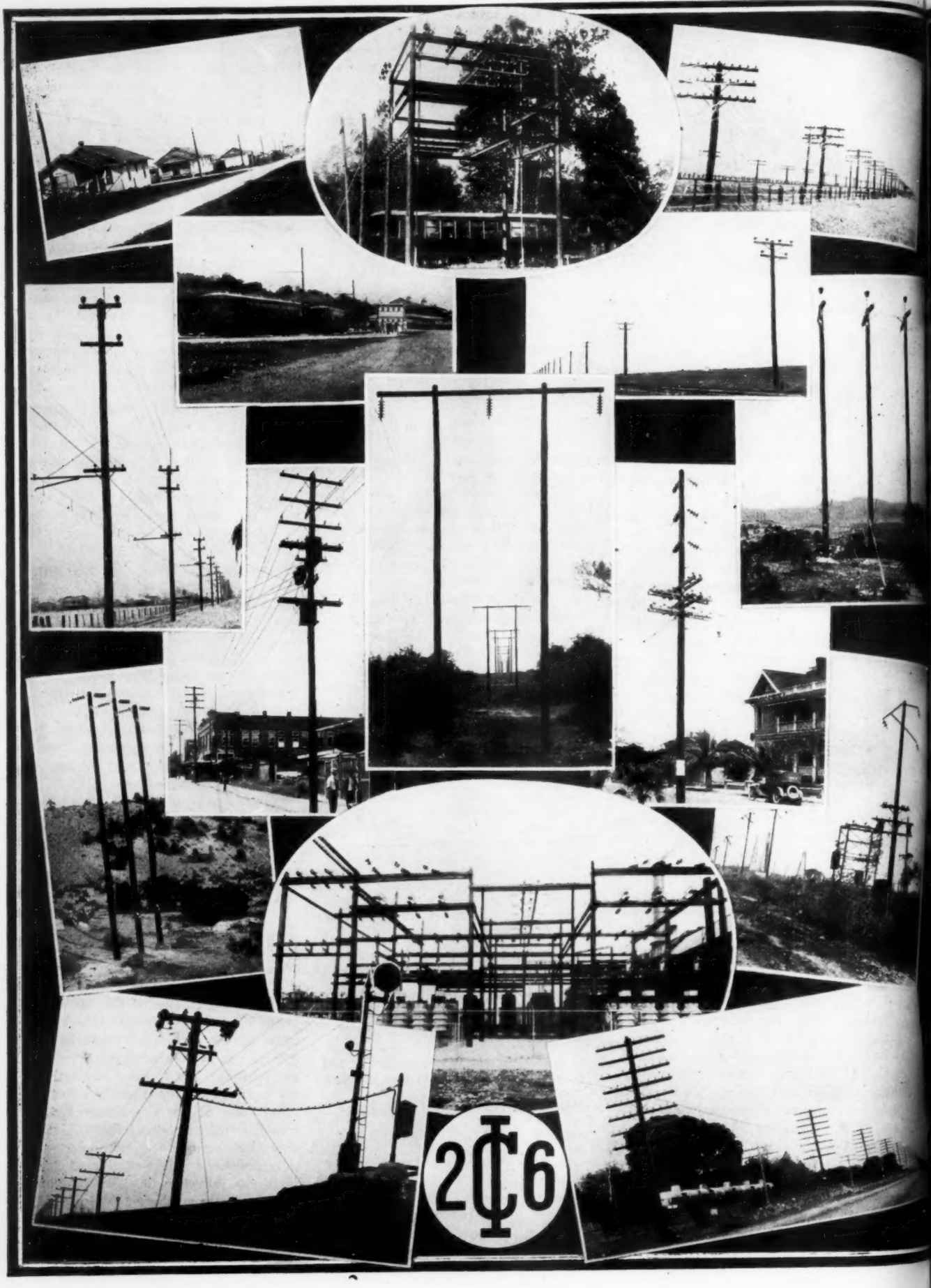
	Electrostatic system.	Electromagnetic system.	Ratio of the two.
Quantity of electricity	$C^{\frac{3}{2}}G^{\frac{1}{2}}S^{-1}$	$C^{\frac{1}{2}}G^{\frac{1}{2}}$	V
Current strength	$C^{\frac{3}{2}}G^{\frac{1}{2}}S^{-2}$	$C^{\frac{1}{2}}G^{\frac{1}{2}}S^{-1}$	V
Capacity	C	$C^{-1}S^2$	V^2
Resistance	$C^{-1}S$	CS^{-1}	V^{-2}
Electromotive force	$C^{\frac{1}{2}}G^{\frac{1}{2}}S^{-1}$	$C^{\frac{3}{2}}G^{\frac{1}{2}}S^{-2}$	V^{-1}

31. Induction

In moving a small coil of wire, whose ends are connected to a galvanometer in the vicinity of a magnet, a deflection of the galvanometer needle will be produced under certain conditions. If the coil is held near either end of the magnet in such a position that some of the magnetic lines proceeding from the magnet pole pass through the coil, and if the coil is then quickly moved out of the field, a pronounced deflection of the needle will indicate the passage of a current around it. This current is due to the pressure of an electromotive force in the coil produced by the cutting by it of the lines of force treading through it. It matters not whether the coil or the magnet or both are moved, as long as there is relative motion to alter the magnetic flux embraced by the coil. It is not sufficient that the lines of force are cut, they must be cut in such a manner that there is a *change* in the number passing through the coil.

A closed coil may be moved in a uniform field in a number of ways, setting up an electromotive force. If a coil, placed with its plane perpendicular to the lines, is carried parallel to the lines, no electromotive force will be induced, nor when the coil is placed at right angles to its initial position, because there is no change in the relation of the field and coil as far as the flux of the former through the latter is concerned. A variation is necessary in the shape of an increase or decrease; if the former induces an electromotive force and consequently a current in one direction, the latter will induce an electromotive force and current in the opposite direction. The effect produced depends on the rapidity of the relative motion between the magnetic field and the conducting circuit. The e. m. f., in fact, is the *time rate of change* of the magnetic flux. If "N" is the whole number of lines of force effectively cut and "t" the interval of time elapsing during the cutting, the e. m. f. generated will be $e = -\frac{dN}{dt}$; *this is Faraday's law of electromotive force.*

In this formula the symbol $\frac{d}{dt}$ is an operator indicating the time rate of change. In this case the time rate of change of N, that is, of the number of lines. We will not discuss this operator at the present time as we would have to go into calculus, an advanced branch of mathematics. The formula signifies that the e. m. f. and the change in flux inclosure are of opposite signs. An increase of the number of lines of force threading through a circuit being considered positive and producing an e. m. f. in one direction in the circuit, a decrease of the number of lines will then be negative, causing an e. m. f. in the opposite direction. If the rate of change in the quantity of the magnetic flux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varies from interval to interval, an interval may be considered so small that the rate remains practically constant during that interval, otherwise the quotient will represent the mean e. m. f.

Fig. 25 may represent the direction of the lines of force of a uniform magnetic field H, in which is placed a linear conductor of the length "l." Let "A" be the

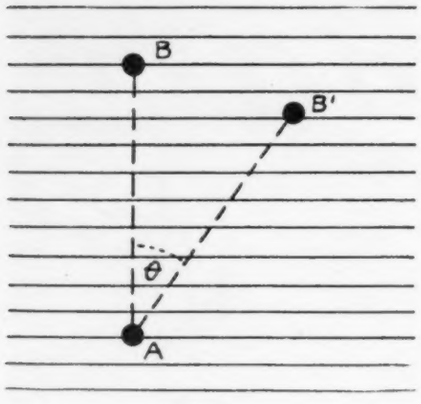


Fig. 25

cross-section and position of the conductor at right angles to the field. If this conductor is moved in any direction except parallel to the lines or in the direction of its length, it will cut lines. If AB represents the perpendicular distance covered in a given time and AB' the oblique equal distance, the number of lines cut during the second movement will be less than those cut during the first movement in the ratio of one to cos θ.

The sign of the motion and with it the direction of the induced current is determined by *Fleming's Rule:* Hold the thumb and the first and second fingers of the *right* hand as nearly as possible in the directions as shown in Fig. 26 at right angles to each other, that is the thumb pointing to the right, the first finger pointing upward and the second finger forward; then, if the forefinger is pointed in the direction of the lines of force and the thumb in the direction of motion, the direction of the second finger will represent the direction of the induced e. m. f. The letters marked on the fingers indicate the direction of motion by V (velocity), the direction of the magnetic field by H, and the direction of the induced e. m. f. by E.

32. Practical Units of Measurement

If the magnetic field is so extensive that the conductor does not pass out of it with continued motion, the e. m. f. can be expressed in terms of the velocity with which the conductor moves. Let "v" be that velocity (cm per second) at right angles to the lines of the field, "l" the length of the conductor (cm), and H the strength of the field (lines per cm²), then the lines cut in a second will be Hlv. If H is unit field (that is, of such a strength as to be represented by one line of force per cm²) and if l is unit length, the number of lines of force cut in one second will be unity. Then the unit of e. m. f. in the C. G. S. electromagnetic system is defined as that produced by the cutting of one line of force per second. This unit of e. m. f is far too small for use in measuring such electrical pressures as are met with in practice, and a larger unit is used instead, which is called the *"volt."* It is equal to one hundred million of C. G. S. units of e. m. f., that is, 10^8 lines of force must be cut per second to produce an e. m. f. numerically equal to the unit called the volt in the practical system of units. The volt is the unit of electrical pressure.

The practical unit of current is the "ampere," which equals 10^{-1} C. G. S. electromagnetic units of current strength and which has been defined by its action on unit magnetic pole.

If a current of strength represented by the ampere is maintained for one second, a quantity of electrification called one *"coulomb"* is said to have passed through the circuit. The coulomb is also equal to 10^{-1} C. G. S. units.

From Ohm's law the magnitude of the unit of resistance in the practical system is found, namely the *"ohm":* as potential difference equals resistance times current, the ohm will be $= \frac{\text{volt}}{\text{ampere}}$. Since one volt $= 10^8$ C. G. S. electromagnetic units, and one ampere $= 10^{-1}$ C. G. S. units, one ohm will be $= \frac{10^8}{10^{-1}} = 10^9$ C. G. S. electromagnetic units. If a difference of potential of one volt is maintained at the extreme ends of a conductor whose

Fig. 26

resistance is one ohm, the current flowing in that conductor will be one ampere.

A condenser has a capacity of one *"farad,"* when charged by a coulomb of electrification to a potential of one volt; that is, when the potential difference at its electrodes is one volt. Hence farad $= \frac{\text{coulomb}}{\text{volt}} = \frac{10^{-1}}{10^8} = 10^{-9}$ C. G. S. electromagnetic units. The practical unit in which induction is measured is the *"henry."* The henry is 10^9 times as large as the induction measured in C. G. S. units; therefore 1 henry $= 10^9$L, where L represents the number of lines of force, which pass through a coil of single turn traversed by unit current and when there are no other currents nor permanent magnets in its neighborhood.

As a unit of work, the *"joule"* has been chosen, which is equal to 10^7 units of work in the C. G. S. system, and which is represented sufficiently well for practical use by the energy expended in one second by one ampere in one ohm.

As a unit of power, the *"watt"* has been adopted, which is equal to 10^7 units of power in the C. G. S. system, and which is represented sufficiently well for practical use by work done at the rate of one joule per second.

33. Trigonometric Relations

It may not be quite plain to everybody that the expression $\frac{\sin\theta}{\cos\theta}$ mentioned in paragraph 29, is equal to tan θ. Therefore we will give an explanation and add the discussion of a few other trigonometric relations at the same time.

In paragraph 27 on Circular and Trigonometric Functions the sin ∝ was expressed by the ratio $\frac{a}{c}$ and the cos ∝ by the ratio $\frac{b}{c}$. From this the quotient $\frac{\sin\propto}{\cos\propto} = \frac{\frac{a}{c}}{\frac{b}{c}}$ is obtained, but $\frac{\frac{a}{c}}{\frac{b}{c}} = \frac{a}{b}$, which has been defined in the same paragraph 27 as tan ∝. Therefore $\frac{\sin\propto}{\cos\propto} = \tan\propto$ and, of course, also $\frac{\sin\theta}{\cos\theta} = \tan\theta$.

If we divide cos ∝ by sin ∝ we obtain $\frac{\cos\propto}{\sin\propto} = \frac{\frac{b}{c}}{\frac{a}{c}} = \frac{b}{a} = \cot\propto$. If we compare the two expressions $\frac{\sin\propto}{\cos\propto} = \tan\propto$ and $\frac{\cos\propto}{\sin\propto} = \cot\propto$, it will be noticed that $\frac{\sin\propto}{\cos\propto}$ is the reciprocal of $\frac{\cos\propto}{\sin\propto}$, hence cot ∝ is the reciprocal of tan ∝ or $\cot\propto = \frac{1}{\tan\propto}$.

As $\sin\propto = \frac{a}{c}$ and $\cos\propto = \frac{b}{c}$, we obtain by squaring the two expressions and adding them together, the following:

$\sin^2\alpha + \cos^2\alpha = \frac{a^2}{c^2} + \frac{b^2}{c^2} = \frac{a^2+b^2}{c^2} = \frac{c^2}{c^2} = 1$. As $\sin^2\alpha + \cos^2\alpha = 1$, we also have $\sin \alpha = \sqrt{1 - \cos^2\alpha}$ and $\cos \alpha = \sqrt{1 - \sin^2\alpha}$. It will be noticed that the square of an angle is not written as $(\sin \alpha)^2$ but as $\sin^2\alpha$.

It must not be lost sight of that all the above relations hold good only for right triangles. The relations for other triangles do not concern us at present.

Texas Has Big District Meet at Tyler

Tyler, Tex.—The fourth annual district meeting of the Texas Independent Telephone Association convened in this city September 22 with 175 delegates present, representing more than thirty-five counties within a hundred miles radius of Tyler. The sessions are being held in the ball-room of the Blackstone Hotel, and were presided over Wednesday by R. B. Still, president of the Texas Independent Telephone Association and general manager of the Gulf States Telephone Company.

The initial day's proceedings were on the order of a school, when subjects of paramount interest to telephone people were treated and discussions of technical subjects of major importance in telephone operation were the main order of procedure. The final days was occupied for the most part with a traffic conference, with some of the foremost telephone men of the state leading the topic discussions.

Nearly 250 guests were banqueted at the Tyler Hotel Wednesday evening, complimentary on the part of the Gulf States Telephone Company of Tyler.

The general session Wednesday afternoon consisted of "Pole Preservation," by R. S. Manley of Orange, president of the Texas Creosoting Company: "Discrimination in Rates and Rules," by L. A. Kayser of Tyler, vice president of the Utilities Finance Corporation: "Necessity for a System of Books and Records," by L. S. Gardner of Waco, auditor of the Texas Long Distance Telephone Company, and "Safety Measures and Emergency Treatment," by Ira Fullerton of Waco, assistant wire chief of the Texas Long Distance Telephone Company of Waco.

A round-table discussion was entered into, conducted by President R. B. Still, when the telephone managers and operators had the privilege of asking any question pertaining to any angle or problem of the telephone business. This general discussion proved both enlightening and interesting.

Public Relations, Plant, Finance Features of Hoosier Meet

Indianapolis, Ind.—What the late Theodore N. Vail said about the telephone industry guarding against anyone losing money through investment in telephone securities was again heard before an audience of telephone men at the annual convention of the Indiana Telephone Association held here September 21-23. This time the counsel came from the head of the national Independent association, F. B. MacKinnon, who spoke on the dangers of the flurry in financing through which the Independent industry is progressing now. This business of safeguarding the stability of the industry against the sharpshooting attacks of promoters who have a policy of coming in, effecting purchases and consolidations and walking out, leaving the security holders holding the bag, also was a feature of the presidential address of Henry A. Barnhart. President Barnhart's address, printed in full elsewhere in this issue, also cautioned the industry against participation in political campaigns and stressed the importance of keeping the plant ship-shape.

Almost three hundred telephone men of the Hoosier state, representing companies having 344,840 telephones and 54,406 miles of toll line, sat in at the sessions and took vigorous part at the informal discussions staged in the many interesting exhibit rooms. The business of the convention, insofar as election of officers was concerned, consisted of returning the present directorate to office. Officers will be elected by these directors later.

The national association will continue to exert every influence to see that the preservation of two strong groups within the industry is the procedure as well as the theory, emphatically stated President MacKinnon of the national Independent body. The U. S. I. T. A. chief cited one case of a bond circular of a recent telephone issue in which there was a wide variation between the actual earnings of the company and the earnings set forth in the circular as being greatly in excess of interest charges, in warning of the urgent necessity of making a deep study of telephone securities and financing methods.

Two of the Independent industry's stars in the establishment and conduct of good-will and commercial campaigns, R. F. Wilder, general commercial manager of the Tri-State T. and T. Company, and Frank E. Bohn, vice-president and general manager of the Home T. and T. Company of Fort Wayne, spoke on getting more revenue from a cordially disposed public. The subject of Mr. Bohn's address was "Advertising Our Business." He told of policies and practices that have worked so successfully in Fort Wayne and detailed the use of newspaper and other forms of advertising as employed in campaigns he has studied. He advocated the adoption and maintenance of a policy of persistency and thoroughness in the telephone advertising campaign that was expected to register correctly. He told of the effect of advertising in increasing the revenue from extension telephones.

Cornerstones of Good Will

Service, courtesy, rates and management are the cornerstones of the public relations structure, said Mr. Wilder. He reminded his hearers that often the user's chief complaint about failure of service is not because of the failure itself but because of a feeling that there was lack of interest on the part of someone in the organization with regard to the user receiving satisfactory service. He told of the importance of the minor details that make the perfect public relations situation and laid out three lines of effort to be followed in producing satisfactory results. These lines being:

1. Endeavoring to render good service.
2. Keeping the public informed as to the company's aims and policies.
3. Developing a spirit of good-will and courtesy among employes.

An illuminating presentation of plant accounting and depreciation methods was presented by Harry Boggs, former auditor for the Indiana Public Service Commission. Mr. Boggs spoke of the difficulty in discriminating between proper charges to maintenance and depreciation as being a major source of confusion to the smaller companies. He gave examples of correct practice and cleared up a number of doubtful points.

The plant and general construction conference, presided over by R. V. Achatz, technical editor of TELEPHONE ENGINEER, brought forth many interesting details of experience. Mr. Achatz gave a chart cost on the cost of poles in place in the line, establishing the cost as $8.22 in the case under consideration. E. B. King, transmission engineer of the Indiana Bell Telephone Company, treated the convention to a most interesting and helpful demonstration on conditions affecting transmission, which made use of amplifying equipment in telling the difference between lines and equipment in good condition and when disturbing causes were present.

Reports of the presidents of the various district associations of Indiana were heard by the convention. An operators' conference was conducted by J. Lloyd Wayne of Indianapolis.

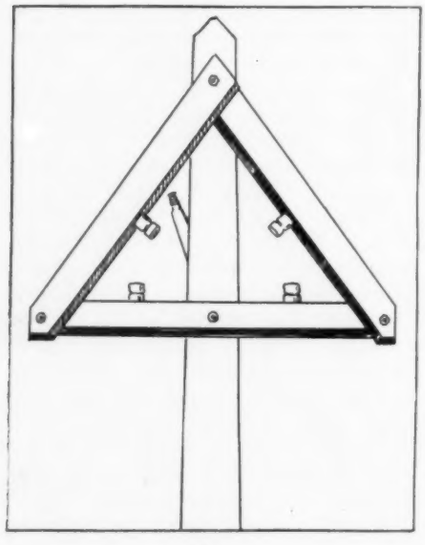
LINE AND DESK

ANOTHER CROSS-TALK REMEDY THAT FAILED

C. E. Gardner, one of the real pioneers of telephone construction in Michigan in a recent number of "The Mouthpiece," tells the following interesting story of an early attempt to eleminate cross-talk:

In the early days of telephone work in Michigan we had to work out our own problems and devise our own methods, to some extent. That brings to my mind an experimental job in an attempt to overcome cross-talk on trunk lines between Saginaw and Bay City, on which I worked.

It was during the winter of 1882-3, and those familiar with the route of the line between these cities at that time can sympathize with that crew during the experience I am relating. For those who do not know the layout, I will say that the line paralleled the Pere Marquette railway through the marshes, and of all of the then desolated parts of Michigan, that was the coldest. The thermometer registered around 18 degrees below zero most of the time, with the wind blowing like h—l all of the time. A cold lunch at noon, eaten around a bonfire, did little toward keeping up the morale of the crew. But at that we were a happy bunch, doing our bit as we saw it, just as thousands of the youngsters in the organization are doing it today.



Part of an Experiment to Eliminate Cross-Talk

Getting down to the job—picture in your mind a 25 foot pole line with one four-pin arm, on each pin a No. 12 iron wire, grounded at each end, the length of the line being approximately 15 miles. It did not make much difference which line you were hooked up on for all four conversations could be heard plainly on any of them. To overcome the difficulty, it was thought that by grouping the four lines around a barbed wire, all the little cross-talk bugs would jump to the points or barbs and run to the ends and leap off into space. At least that was the way we hikers looked at the plan. Just what the Research department's idea was, I am unable to say, for at that time we had never heard of General J. J. Carty or any of his able assistants.

The plans and specifications for the job were shown in a little note book carried in the vest pocket of the foreman. The instruction read like this:

> "Lower the four-pin arm to the section gain; from each end of arm to top of pole place 1"x3" pine board with porcelain knobs on under edge; transfer the end pin wires to knobs.
>
> "The barbed wire is to be placed on brackets above the arm alternating from railroad side to field side at every other pole."

The accompanying sketch, roughly drawn, is shown here. After several weeks' hard work and ruining of many pairs of overalls and gloves and the loss of many patches of skin, the job was completed and ready for tryout. At each end the barbed wire was carried high above the coupla of the exchange where the bugs were supposed to jump off and disappear, never to annoy us again.

Did it work?

No, never! We decided it might be well to turn down the ends of the barbed wire to the ground, compelling the little devils to bury themselves. But results no better.

The next trial was grounding the wire in the center and finally we wound up by grounding it every 10 poles. It was a failure any way we experimented.

I sometimes think it must have been this and other experiments, that I may tell you of later, that started Mr. Carty on his way toward developing metallic circuits.

MORE ABOUT SOLDERING

Editor, TELEPHONE ENGINEER:

The system advanced by W. V. Sylvester in the July number of TELEPHONE ENGINEER for making soldered connections is a new one to me, but I must say that it has many advantages for certain classes of work. I agree that a small contact well soldered is all that is necessary in most cases; also that most connections in telephone work are not ordinarily subjected to mechanical strain but are they all not more or less likely to be damaged by vibration if not mechanically strong? How about connections on jacks in a heavy multiple where in case of trouble it is necessary to drive a wedge in between the cables to make an opening to get into the connection to repair it? In most cases of this kind even when utmost care is practiced some mechanical strain is placed on the connections, and if the wire were just soldered on the side of the terminal, would the rosin core solder be equal to the strain? I have never been in favor wrapping wire around terminals several times, but only one and one-half turns and when there is a hole in the terminal, pass the wire through once and then bend it back. This seems to be the approved practice of many. Usually a few rosin joints will creep in on a big job in spite of all precautions. But by using good clean soldering coppers of a proper heat and plenty of time in soldering believe joint can be made both strong mechanically and good electrically and that rosin joints will be reduced to a minimum.

—Ray Blain.

TRANSMITTER BATTERY FOR MAGNETO EXCHANGE

We have the following letter from a subscriber:

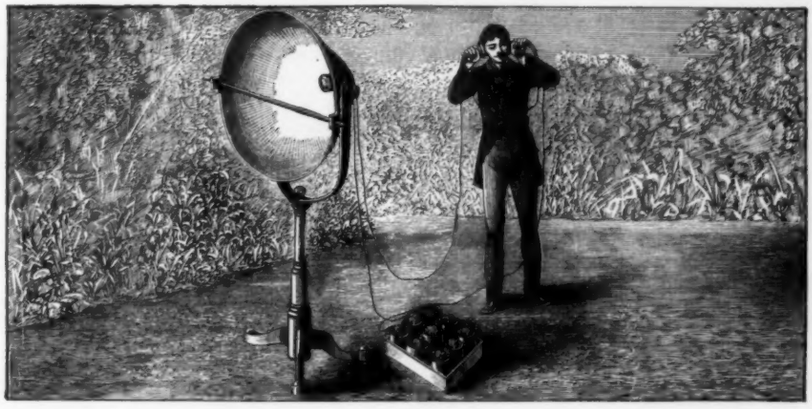
"We operate a magneto exchange. We want to get away from the use of gravity batteries for the operation of our operator's switchboard transmitter. We supply 3 v. to transmitter. The primary of the induction coil is wound to 1.4 and the secondary 175 ohms.

"The question we would like to put to you is this: Is there any good substitute battery in place of the old crowfoot gravity type that will give satisfaction on an operator's transmitter and avoid so much attention as the gravity cells require?

"The draw of the transmitter seems to be about .110 milliamperes. Would a 90 or 120 amp. hour 4 v. storage battery be the one to use, or say two of them with a DPDT switch for each battery to charger?"

It would seem that there is little reason to continue using the old gravity type

Telephoning over a ray of light



Building on the Telephone Principle

FIFTY years ago Alexander Graham Bell discovered the principle of the telephone. His first telephone employed wire as the connecting path over which words passed. Four years later he used a beam of light instead of wire to carry speech between telephone instruments.

Today, both wire and wireless telephony are employed on every hand in the service of the nation. Wire telephony, with its thousands of central offices, its complex switchboards and millions of miles of wire, envelops the country, carrying for the American people 70,000,000 conversations every day. Wireless telephony is broadcasting entertainment and carrying important information to the remotest regions.

But new applications of the telephone principle are still being found. In the loud speaker, in the deaf set, the electrical stethoscope, the improved phonograph, the telephone principle has been adapted by the Bell Telephone Laboratories to the uses of the physician, the public speaker and the musician. The scientific research and engineering skill, which enable America to lead the world in telephone service, are also bringing forth from the telephone principle other devices of great usefulness.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

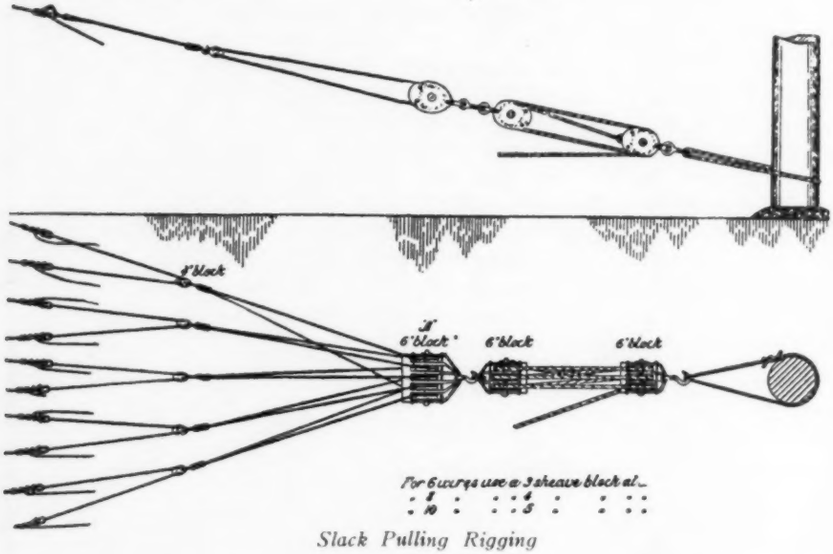
BELL SYSTEM

IN ITS SEMI-CENTENNIAL YEAR THE BELL SYSTEM LOOKS FORWARD TO CONTINUED PROGRESS IN TELEPHONE COMMUNICATION

battery for operator's transmitter supply when nearly every town is supplied with power service of some kind. There are many types of storage batteries on the market and a large number of battery-charging devices at very low prices. It would seem that some of these should provide an excellent outfit for the small exchange at a low cost. It is likely that the lower priced chargers would not give noiseless operation if the battery is to be used at the same time it is charged. Some of the more expensive chargers are arranged for "trickle charging," that is, for charging at a slow rate while the battery is in use. It is a question of cost between one of the more expensive charging outfits and one battery; or a cheaper charger and two batteries with a switch to change from one to the other. Perhaps some of our readers in the smaller exchange can give us some of their experiences along this line.

PULLING SLACK IN SEVERAL LINES AT ONE TIME

We have an inquiry for information as to the method of rigging pulleys so that slack in a number of wires may be pulled evenly at one operation. The inquirer recalls having seen such an arrangement described but is unable to locate the reference, due to not having a complete file of back numbers.



Slack Pulling Rigging

The arrangement was illustrated in P. Kerr Higgins' article in the December, 1924, issue of TELEPHONE ENGINEER. We are reproducing the cut from that number in order to give the desired information. In passing, it may be remarked, that the value of a journal lies not alone in its current reading but in its usefulness for future reference. A complete file of back numbers would have provided this information much more quickly than is possible to provide through an answer to an inquiry.

Braden Winch Has Many Uses in Telephone Work

Tulsa, Okla.—With the spreading of the news of its performance the R-B Winch made by the Braden Steel and Winch Co. is rapidly adding to its already large list of telephone company users.

The winch has proved to be a decided help in setting poles, pulling wire and cable, loading and unloading equipment, and in a number of other everyday jobs in the telephone industry.

The R-B type FT winch is designed for installation on a Ford one-ton truck and is claimed to have a wider variation of uses than any other machine of its kind. It is readily installed, being operated through the rear axle shaft, independent of the rear wheel and without any necessity of jacking up the wheel. It is out of the way, does not occupy valuable bed space and is said to be at its best when the truck is loaded.

Its manufacturer, the Braden Steel & Winch Co., of Tulsa, Okla., asserts that it is made of the best materials obtainable for the purposes intended, with a minimum of working parts and nothing to get out of order. It is stated that in the numerous tests to which this winch has been subjected, it has been demonstrated that it is a regular glutton for punishment; it simply cannot be put out of commission.

The drum of the winch is a semi-steel casting of high tensile strength and wear-resisting qualities. The design of the flanges, together with the special material of which they are made, enables them to withstand high shock pressures and safely override encountered projections in cross-country travel. It is machined to very close tolerance, which allows a snug fit and insures long life under the hardest usage.

Each R-B winch drum is prepared and ready to receive the special cathead and belt power pulley which are attached thereto with four bolts. This gives the user a combination of appliances which are said to meet the demand for a wider variation of uses than any other machine of its kind.

The hub is cast from high carbon electric steel, is heat treated and machined over its entire surface. With its increased flange diameter, the hub greatly adds to the strength of the wheel and gives a rigid brake drum mounting.

The hub has an approved Timken bearing mounting, fully adjustable for wear, and is protected against the entrance of dust and dirt, as well as retaining the encased lubricant. The hub, which is of the extended type, forms the large main bearing for the rotating drum.

The sliding clutch is made of high carbon steel, forged, machined and heat treated. It is of the six-spline tooth design which drives the wheel when in road position and, when withdrawn from the road position to the cable drum, supplies the positive drive for the winch. It is set over the special R-B axle with a sliding fit over the internal splines and eliminates all keys and nuts usually employed for this purpose. Engagement of the clutch with the hub teeth and winch teeth is semi-automatic.

Australia to Have New Carrier Systems

New York City—International Telephone and Telegraph Corp. announces that its subsidiary, International Standard Electric Corp., is in receipt of an order from the Australian government for carrier telephone systems including apparatus for seven repeater stations. When completed, the new equipment will provide the equivalent of three additional telephone circuits between each of the following centers: Sydney and Brisbane, approximately 600 miles; Sydney and Grafton, 528 miles; Sydney and New Castle, 102 miles; Sydney and West Maitland, 120 miles; Sydney and Tamworth, 282 miles; Sydney and Armidale, 313 miles.

No stringing of overhead wire or cable will be necessary for these additional eighteen telephone channels as the carrier will be superimposed on existing wire lines by means of high frequency currents without disturbing circuits already in use. The success of the "carrier" installed last year between Sydney and Melbourne has been widely commented on, especially as regards the rapidity with which calls are completed. Previously, there was an average delay of a little more than half an hour in obtaining a connection whereas with the new system a call is completed in five to six minutes. The results have been an increase of toll traffic of over 100%.

Survey as First Step in Marketing Telephone Service

By B. H. BRANDT*

(Commercial Engineer, Michigan Bell Telephone Company)

Production and marketing of a commodity constitute the essentials of every enterprise. In our business, service is the commodity produced and sold. It is the direct responsibility of the Commercial department to locate the market for our service, to see that the market is supplied with the service required and to collect payment for the service rendered.

Our views concerning the sale of telephone service have undergone marked changes since the inception of the business. At the outset, equipment was sold for private use and sales effort was centered on convincing the public of the practicalness of the telephone. Later, service was sold to those who leased equipment and, as the telephone became increasingly popular, the demand for service ran ahead of the supply of facilities and the service came to be bought rather than sold. For the past few years, increasing effort has been made to measure the results of management in all lines of business; attention has been focused on the cost of individual transactions and out of that process there has arisen a general feeling that all parties to a transaction should profit. The present stage, therefore, implies acceptance of "customer satisfaction" as a dominating consideration in the sale of all commodities, including telephone service.

Largely owing to the demand for better service in quantities which ran ahead of the supply of facilities, improvements in telephony have been centered on the design of equipment, operating technique and accounting procedure, to no small extent. In the meantime, betterments in Commercial service, naturally, did not receive a corresponding degree of attention. Recently however, an active program of Commercial research work has been undertaken as applied to Commercial office administration and telephone sales methods. Information of the customers' use of the service is essential to the correct understanding of the legitimate demand for both new equipment and modifications in existing equipment, as well as to proper methods of procedure in the sale of service.

The telephone service survey is one form of sales effort which recognizes our Company's responsibility to not only furnish certain kinds of service, but to make certain that the service so provided, when properly and systematically used, will fully meet the subscriber's requirements. In other words, the telephone service survey is a form of creative salesmanship which has fundamental commercial research aspects. The survey stresses these considerations which directly concern the subscriber: (1) All sales of service must be made to fit his exact requirement. (2) The service purchased must render the service expected. (3) Complete information relative to the operation and use of equipment must be provided. (4) Every aid to profitable employment of the telephone must be rendered.

Surveys are made for those private branch exchange subscribers who experience service difficulties which appear to be due to an improper equipment layout and for those whose business is of a type which, on the surface, appears to offer a fertile field for obtaining first-hand information on the industry of which it is a part and which likewise indicates the opportunity for doing constructive work and promoting the direct use of telephone service in the production and marketing of commodities.

The Information Sought

Each survey involves an investigation of the four following items:

1—To determine that the subscriber's equipment is adequate, though not in excess of his present needs; that it is functioning properly and is conveniently located to promote efficient usage.

That portion of the survey involves taking a three-day Traffic study to determine the volume of traffic passing through the subscriber's switchboard to ascertain whether the existing trunk lines are adequate. An inspection is made of the equipment to insure that it is functioning properly, and a study is made of the various processes involving the carrying on of the patron's business to determine whether the layout of the telephone equipment meets requirements.

2—To ascertain whether the practices observed by the subscriber's switchboard attendants and other employees are conducive to his obtaining full value from the service and to the maintenance of cordial contact with his trade.

The Traffic observer who makes the study assists us materially through noting any undesirable telephone practices of the attendants and extension users. Her observations are supplemented by ours, as gained during the course of interviews with employees and while passing through the organization inspecting equipment, etc. The combined findings are discussed with the subscriber management and copies of a series of desirable telephone habits are made available for distribution.

3—An analysis is made of the subscriber's present use of local and long distance service to determine whether the most efficient usage is being employed.

The use made of local service is secured through interviews and personal observation. Instances where costs are being incurred which are unwarranted, such as an unreasonable amount of personal calling, are brought to the subscriber's attention.

Help with Toll Service

The patron's long distance usage is analyzed. The details of each call are entered on a special form and the persons who made the calls are interviewed. Where person-to-person service has been used, effort is made to get the facts on each call to determine whether station-to-station service might have met requirements. Explanation of the various toll classifications is made to promote better understanding and more economical use of the toll service. Where warranted, a toll chart covering calls to the more frequently called points is prepared for the subscriber for guidance in filing calls. Special effort is made to promote the proper use of station-to-station service since it is recognized that the use of that classification not only is more economical and faster for the subscriber but likewise increases the earning capacity of our toll plant. Where the bulk of calls are filed during the hours of our peak period, we endeavor to sell the idea of filing those calls whose nature permits some leeway, during hours outside of our peak, emphasizing the speedier completion possible.

4—To analyze the subscriber's problems from the telephone standpoint in an effort to suggest added ways in which to use the telephone in the conduct of his business in order that our service may provide for him the maximum benefit at minimum cast.

To promote a more effective use of

*Courtesy the Mouthpiece.

the subscriber's telephone service in the conduct of his business requires an analysis of his processes of purchasing material, their manufacture and methods of distribution. That information is gained through observation, study of catalogs and other literature, and from interviews with the superintendent, salesmen and salesmanager. On the basis of the facts so gained, effort is made to formulate sales plans and suggestions in involving the use of local and long distance service, not only as applied to the subscriber himself, but to his distributors and their salesmen. Effort is made to promote the blending of salesmen's visits with telephone calls and to further the use of sequence toll call lists.

The results obtained through our investigation are embodied in a complete report, copies of which are given the subscriber, the manager of the district involved, the Traffic department and the general Commercial superintendent, who forwards one copy to the American Telephone & Telegraph company for its files where it is available for the other associated companies who may have occasion to survey firms in the same or similar lines of business. That copy is likewise available in undertaking system-wire studies of the various related industries as a whole.

What Survey Accomplishes

While telephone service surveys are not always immediately profitable, they do disclose facts which are essential to successful sales and subscriber service. In many instances, a definite need for additional equipment is brought to light. In the other hand, there have been instances where more equipment was in service than the subscriber required and recommendations were made for its discontinuance.

In general, these surveys should promote a better understanding of the demands on the telephone, which should enable us to better serve our patrons; they foster the discovery of new possibilities for using the telephone and the studying of their limitations; they promote the sale of local and long distance service and equipment and bring together data which, collectively, may be of value in effecting desirable additions to, or changes in, existing standard equipment; they provide the opportunity for getting first-hand information on the demands of service usage, which carries the possibility of influencing the time and manner in which subscribers' calls are made, which in turn may serve to reduce the extreme traffic peaks or at least make them a less important consideration, and they have a definite public relations value by promoting the discovery of causes for dissatisfaction, through providing the chance for making a wide, more or less intimate range of acquaintance.

Speed Work in Spanish Construction

New York City.—The International Telephone and Telegraph corporation has received word from the Marquis de Urquijo, president of its Spanish associated company, the Compania Telefonica Nacional de Espana, of the inauguration of a thoroughly modern automatic telephone system in the city of Santander, Spain. Santander is the seat of the Royal summer residence, and the King officiated in person at the inauguration of the service. Santander is the first of nineteen Spanish cities in which the Compania Telefonica Nacional de Espana has agreed to substitute automatic telephone exchanges for the old system of manual operation within the next three years. Since the first of the year the company has constructed new central office buildings to accommodate the various exchanges of Santander and Madrid, has substituted underground for overhead cables, and has installed entirely new central office equipment in both cities. This is said to constitute a record in rapid telephone constructions, and the inauguration of the new service in Madrid is expected to follow very shortly after that in Santander.

Besides the installation of the new telephone service in Santander, the Standard Electrica, S. A., a manufacturing subsidiary of the International Corporation is now constructing at that point a modern factory for producing telephone cables for both the domestic and export markets.

Shieks Mourn Changing of Dallas Numbers

Dallas, Texas.—Changing of several thousand Dallas telephone numbers has played havoc with the personally compiled sheba directories of the native drug store cow-boys, according to local newspaper stories.

Berlin, Germany.—About 100,000,000 marks is to be used by the German post office for development of the telephone system.

Mt. Gilead (O.) Company Changes Hands

Mt. Gilead, O.—Morrow County Telephone company has been bought by Thompson, Kent and Grace of Chicago. Extensive improvements are contemplated by the new owners. Officers of the company at the time of its sale were V. W. Peck, president; J. W. Glauner, vice president; Perry Cook, secretary-treasurer, and Ray Tenant, general manager.

Blooming Prairie, Minn.—Steel County Telephone Association and Ellendale Rural Telephone Company have been merged.

Telephone Taxes Almost Double Bite Into Revenue

Chicago, Ill.—Telephone taxation is so important that Professor Herbert B. Dorau of the Institute for Research in Land Economics and Public Utilities, of Northwestern University, has made special studies of telephone taxation at the Interstate Commerce Commission office in Washington to learn just what the drain upon the telephone companies' purses taxation has come to be.

The percentage of taxes to revenue has been discovered by Prof. Dorau for Class A telephone companies in the United States since 1916, to show the following contrast:

Year	Revenue	Taxes	Per Cent Taxes to Revenue
1916	283,174,890	15,710,912	5.55
1917	318,066,185	22,022,365	6.92
1918	343,461,714	24,423,016	7.11
1919	409,683,483	27,027,687	6.60
1920	488,943,281	30,276,231	6.19
1921	541,196,417	37,340,878	6.90
1922	591,530,687	43,875,022	7.42
1923	647,112,210	48,754,632	7.53
1924	704,177,348	53,782,781	7.63
1925	791,507,221	61,627,223	7.79

Prof. Dorau has not completed his inquiry but enough is known, according to the Bell Telephone News, to prove that there are more than fifty-seven different varieties of taxes in the United States.

Historic Interest in Veteran's Card

Elgin, Ill.—On the back of the business car of Wm. Hubbard, who is still exceedingly active in the newest branch of the communication business, radio, there is an illustration that brings back memories of the first telephones installed in Elgin. Mr. Hubbard reproduces a wood cut of his first installation outfit. With the equipment carried in this wagon he gave Elgin an early start in telephoning, for in 1879 his business was doing well as a pioneer enterprise.

Mr. Hubbard recently has been comparing reminiscences with other veterans as he attended the Telephone Pioneers of America meeting and plans to be present at the Old Time Telegraphers' Historical Association conventions.

Redlands (Calif.) Tells Story to Patrons

Redlands, Cal.—An interesting little booklet combining toll service rates and telephone service talks to employees and patrons has been issued by the Southwestern Home Telephone Company. The service talks to employees is a particularly well done and strategic piece of work as it deftly impresses the patron with the company's ideals and efforts to perfect its service and increase the public good-will.

Independents Marshall Forces at Chicago

Chicago, Ill.—At the thirtieth annual convention of the United States Independent Telephone Association, to be held at Hotel Sherman, Chicago, October 12-15, the subject of telephone company financing will transcend other details of the program in the amount of featuring it gets, although the plant, operating and accounting conferences will get their usual prominence and treatment by the field's acknowledged authorities.

Three notable speakers will handle the subject of telephone company financing from three different angles. Heading the telephone financing talent that will shine at the big Independent meeting is David F. Houston, president of the Bell Telephone Securities Company and vice president of the American T. and T. Company. Mr. Houston will speak on telephone financing as one who has had more to do with this phase of the industry's activities than any other man in the field. During the first general session, that of October 13, Herbert R. Dorau, assistant professor of economics, Northwestern University School of Commerce, and research associate in the Institute for Research in Land Economics and Public Utilities, will address the Independents on "Fundamental Principles of Sound Financing." Some extremely "close-up" and practical information on the legal phases of telephone company organization and financing will be forthcoming in the address made by Harold L. Beyer, member Cassels, Potter and Bentley, attorneys of Chicago.

The association's work to protect investors in telephone securities and thus to protect the telephone companies themselves in their financing operations will come to a sharp focus at this convention. President MacKinnon's administrations have found the financing phase of Independent development constantly growing in importance. Now financing has been spotlighted by more action than the Independent industry has seen for many years. It is expected that the practical character of the information yielded by the formal addresses and lively discussions that are bound to take place will be instrumental in drawing the biggest attendance of Independent executives ever brought together during the last ten years.

Exhibitors in Big Show

Although advance reports from exhibitors make no promise of the introduction of revolutionary equipment and supplies at the meeting, the manufacturers this year are planning their showings with extreme care and thoroughness. They are confidently of the belief that the era of substantial and correct financing the association is striving to bring will have a decided effect in promoting rehabilitation and extension of properties and consequently a brisk period of buying.

Scheduled entertainment for the convention has as its big event the annual banquet of the Independent pioneers, whose number now is approaching the 1000 mark on the veteran's association's official rotser.

The program, as announced by the U. S. I. T. A.:

TUESDAY, OCTOBER 12, 10 A. M.

Meeting of Association Board of Directors.

Registration.

Opening of Exhibits.

GENERAL OPENING SESSION, TUESDAY, 2:30 P. M.

Report of Secretary-Treasurer, Chas. C. Deering.

Report of Accounting Division by Chairman A. C. Cragg.

Report of Plant Division by Chairman A. L. Staderman.

Report of Traffic Division by Chairman Chas. C. Deering.

Report of Washington Office by General Attorney Alfred L. Geiger.

Appointment of Committees.

Miscellaneous Business.

Dinner for Officers of State Association (6:30 P. M.).

GENERAL SESSION, WEDNESDAY, OCTOBER 13, 10 A. M.

Annual Address by President F. B. MacKinnon.

Address: "Fundamental Principles of Sound Financing," by Herbert R. Dorau, Assistant Professor of Economics, Northwestern University, School of Commerce, Research Associate in the Institute for Research in Land Economics and Public Utilities.

Address: "Some Legal Phases of Telephone Company Organization and Financing," by Harold L. Beyer, member, Cassels, Potter & Bentley, Attorneys, Chicago.

DIVISION LUNCHEON CONFERENCES, WEDNESDAY, 1 P. M.

ACCOUNTING CONFERENCES.

A. C. Cragg, General Auditor, Tri-State Telephone and Telegraph Company, St. Paul, Minnesota, Chairman.

Discussion and Explanation of "Interpretation of Plant Accounting" and "Field Handbook" which have been compiled and printed by the Accounting Committee and will be distributed at Convention.

OPEN FORUM

For Discussion of Accounting Questions submitted by Member Companies.

PLANT CONFERENCE

A. L. Staderman, Chief Engineer, Citizen's Independent Telephone and Telegraph Company, Terre Haute, Indiana, Chairman.

"Use of Concrete with Underground Conduit."

"Code for Drawings."

"Economy of Copper Over Iron Wire."

"Maximum Sizes of Aerial Cable."

"Unit Pole Costs."

OPEN FORUM

For Discussion of Plant Problems submitted by Member Companies.

TRAFFIC CONFERENCE

Chas. C. Deering, President Iowa Independent Toll Clearing House, Secretary United States Independent Telephone Association, Chairman.

"How Better Operating Methods Pay," by Sam. H. Shutt, General Superintendent, Texas Long Distance Telephone Company, Waco, Texas.

"Central Office Management," by W. I. Howard, Traffic Superintendent, Tri-State Telephone and Telegraph Company, St. Paul, Minnesota.

"Analysis of Operators' Work Time," by R. F. Pagels, Traffic Superintendent, Warren and Niles Telephone Company, Warren, Ohio.

GENERAL SESSION, THURSDAY, OCTOBER 14, 10 A. M.

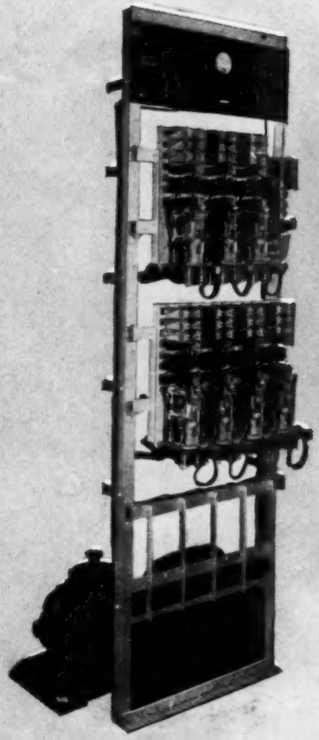
Address: "Commission Approval of Public Utility Securities," by Thorne A. Browne, Industrial Commissioner, Chamber of Commerce, Omaha, Nebraska—formerly Member and Chairman Nebraska Railway Commission.

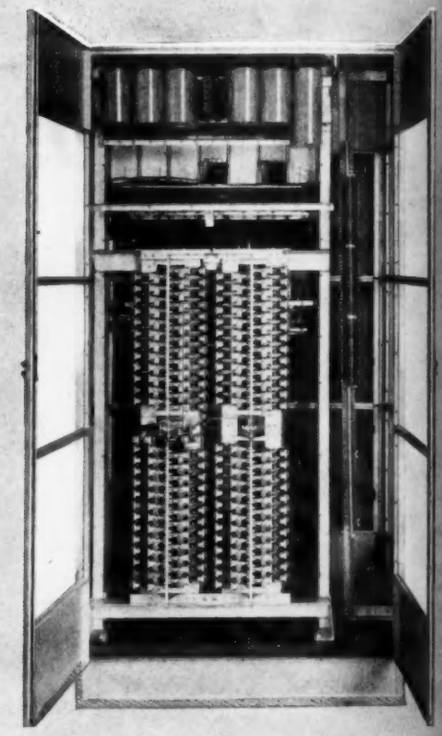
Address: "Telephone Financing," by David F. Houston, President Bell Telephone Securities Company, Vice President American Telephone and Telegraph Company, New York.

THURSDAY, 1 P. M., PIONEERS LUNCH AND ENTERTAINMENT

Annual meeting Pioneers Telephone Association.

See These New Products at





The Type 15 Exchange

Here is a Strowger Automatic switchboard that will fit economically into the very smallest rural exchange. It is built of standard Strowger Automatic switches, but designed so simply that it is a good paying investment even for exchanges of a half dozen lines or less.

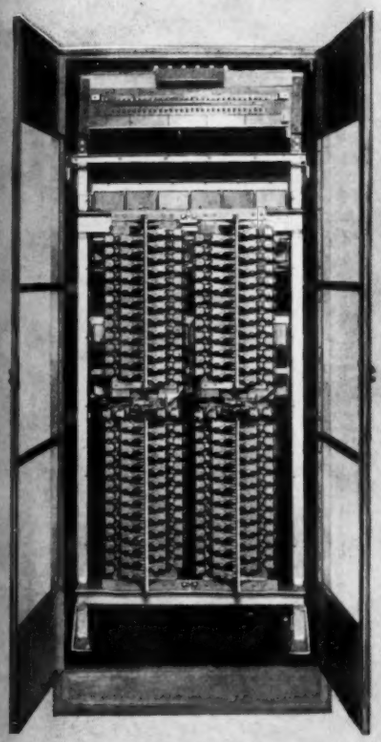
Just place dials on your magneto telephones and install the Type 15 Switchboard. Thereafter your subscribers will enjoy the highest grade of service. Takes care of rural lines of any capacity.

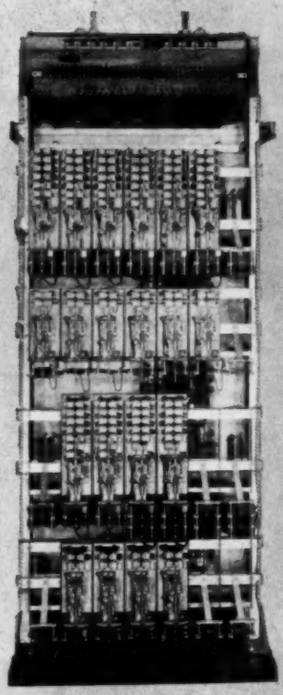
The Type 5 P-A-X

The P-A-X (Private Automatic Exchange), is internationally known as the most modern private exchange system. The Type 5 P-A-X has recently been re-designed to permit the use of rectifier charging apparatus as a means of maintaining the battery in a fully charged condition.

This unit, with an initial capacity of one hundred lines, may be expanded indefinitely as needed, and may be had with or without facilities for trunk connections to public exchanges.

Strowger Automatic Telephone Convention





The Type 18 Exchange

This Strowger Automatic Exchange like the Type 15, makes use of the existing magneto telephones. To meet the demand for a system of low initial cost and fairly large capacity, the telephone lines are terminated on line switches instead of individual connectors.

Ringing is by code (from one to five rings on each side of the line) automatically controlled from the connector switches; in other words, this is a standard Strowger Automatic switchboard, adapted for use with magneto telephones.

The Semi-Automatic Magneto Exchange

This new switchboard, developed especially to meet the needs of telephone companies operating networks of small exchanges, renders a highly efficient service at a very low cost. It makes use of existing magneto telephones.

All local connections are set up by the automatic switches of the S-A-M-X, the apparatus being controlled at the central exchange by an operator, who also handles all toll calls.

GENERAL SESSION, FRIDAY, OCTOBER 15, 9:30 A. M.

Address: "Telephone Company Taxation," by Alfred L. Geiger, General Attorney, United States Independent Telephone Association, Washington, D. C.

Discussion of Resolutions and Proposals.

Reports of Committees.

General Business.

EXHIBITORS AT NATIONAL CONVENTION

Addressograph Company, 901 W. Van Buren St., Chicago.

American Appraisal Co., Milwaukee, Wis.

Automatic Electric Co., 1027 W. Van Buren St., Chicago.

Lynton T. Block & Co., 511 Locust St., St. Louis, Mo.

Bowdle Accounting System, Cerro Gordo, Ill.

Carbon Products Company, Lancaster, Ohio.

Coffey System & Audit Co., 118 E. New York St., Indianapolis, Ind.

Cook Electric Company, 2700 Southport Ave., Chicago.

Copperweld Steel Co., 129 S. Jefferson St., Chicago.

L. M. Berry & Co., Keith Building, Dayton, Ohio.

Electric Storage Battery Co., Marquette Building, Chicago.

French Battery Company, Conway Building, Chicago.

Harrah Manufacturing Company, Bloomfield, Ind.

Holtzer-Cabot Electric Co., 6161 S. State St., Chicago.

Illinois Electric Co., 314 W. Madison St., Chicago.

Iron Products Co., La Crosse, Wis.

Johnson, A. J., 217 N. Desplaines St., Chicago.

Kellogg Switchboard & Supply Co., 1066 W. Adams St., Chicago.

Leich Electric Co., Genoa, Illinois.

Monarch Telephone Manufacturing Company, 1027 W. Van Buren St., Chicago.

National Cable Compound Company, Mitchell, Indiana.

National Carbon Company, 37th St. and Jasper Place, Chicago.

Page & Hill Company, 814 Plymouth Building, Minneapolis, Minn.

Quick Directory Company, 2942 N. Capital Ave., Indianapolis, Ind.

Reliable Electric Co., 3145 Carroll Ave., Chicago.

John A. Roebling's Sons Co., 164 W. Lake St., Chicago.

Runzel-Lenz Electric Manufacturing Co., 1751 N. Western Ave., Chicago.

Sands Electric Co., 1920 Marquette Ave., North Chicago, Ill.

Stacy Swivel Load Binders, Tiffin, O.

Stromberg-Carlson Tel. Mfg. Co., 17 S. Jefferson St., Chicago.

Templeton-Kenly & Co., Ltd., 1020 S. Central Ave., Chicago.

Unique Manufacturing Co., 113 N. Desplaines St., Chicago.

West Mfg. Co., Abilene, Kan.

A. E. Keith, Automatic Pioneer, Dies at Chicago

Chicago, Ill.—Alexander E. Keith, consulting engineer for Automatic Electric Inc., and a prominent figure in the development of the automatic telephone since its inception died here, September 24, age 66.

In 1893 Mr. Keith joined the Strowger Automatic Exchange organization, coming into that association from the Brusk Electric Company at Baltimore. Mr. Keith's electrical genius contributed to the new automatic organization a talent for development work that was of great value in overcoming the many problems standing between the automatic idea and its performance in actual service. Teamed with Joseph Harris as the financial wizard of the struggling outfit, and aided by an enthusiastic and able group of technical experts, Mr. Keith soon had the Strowger system working acceptably. For 35 years he lived with the automatic telephone and gave to its advancement the impetus of his many inventions, many of which have figured as the major factors in the technical development of the automatic telephone. He shared the fortune of Dr. Bell, in living to see the results of his prolific inventive genius endorsed by world-wide business. One of the high spots of his career as a telephone engineer was the invention of the Keith line-switch which helped to bring the cost of Strowger installations down to the point where they could compete on a financial basis with other types of telephone equipment.

For many years Mr. Keith was chief engineer of the Automatic organization. In 1921 he was made vice-president of the organization with general supervision over development and research. A year ago he was made consulting engineer for the organization and in this capacity made valuable use of his extensive experience in the problems of automatic telephone development since the infancy of that phase of the industry's work. His counsel was invaluable to his associates in the organization he served so well in building to its present greatness.

The funeral was held at the family residence at 5455 Hyde Park boulevard, Chicago, on Monday, September 27, at one o'clock. Honorary pallbearers were Theodor Gary, Joseph Harris, H. L. Gary, H. L. Harris, Grant Pelton, J. B. Russell, and Frank Woods. On behalf of the Automatic Telephone Mfg. Co., Ltd., Liverpool, England, and the International Automatic Telephone Co., Ltd., London, G. W. Moore, manager of the Liverpool company, who is visiting in this country, sent a floral tribute.

Mr. Keith is survived by his wife, Grace O. Keith, and five children, Mrs. Helen, Puetz, Dorothy, Elisworth, Gilbert and Jerome Keith.

Knapp Properties to Unite in Ohio Merger

Bellevue, O.—At separate meetings of the Board of Directors of The Local, Bellevue Home, Galion, Crestline Local, Wood County, Oberlin and Medina Telephone Companies held at the General Offices of the companies on September twenty-seventh, each Board approved a plan which contemplates uniting all of the companies into one large corporate entity.

The tying together of the above named companies with the addition of The New Ottawa County Telephone Company will make a property of 23,654 telephones, furnishing local and long distance service to thirty-three towns in twelve counties of northern Ohio. The combined companies would have an independent toll system of over 750 miles to which is linked approximately 800 miles of additional independent connecting company toll lines. This permits of a possible toll connection over our own and independent connecting toll lines with more than 80,000 independent company telephones. The combined property values of our nine companies is slightly over three million dollars, which is by far the largest independent telephone and toll system in the state.

Frank A. Knapp of Bellevue, heads the organization.

Safety "Applesauce" Is Dessert to Thousands

Twenty-three persons are accidentally injured every minute; 1,380 every hour; 33,120 every day; 12,088,800 every year. And yet, you hear some numb-skull make the remark, "Why all this rot about safety? It's nothing but a lot of applesauce." So the next time you hear some such remark as above, give the party these figures. You might also add that since organized accident prevention began, the average number of cases per capita have decreased over fifty per cent, therefore, we know even though it be called "applesauce" it has been a mighty sweet dessert to thousands.—Accident Prevention Committee, Illinois Bell Telephone Company.

Higgins Heads Daviess County (Mo.) Company

St. Louis, Mo.—P. Kerr Higgins has been elected president and general manager of the Daviess County Telephone Company. This company has headquarters at Gallatin, Mo., and operates four exchanges. Mr. Higgins is interested in a number of other Missouri Independent properties.

Wire Tie-Up Important Feature of Broadcasting

Extensive use of long distance telephone wire for interconnection of radio stations has come to be a feature of radio broadcasting. By far the best known and most comprehensive system is that joined up with WEAF almost nightly over the long lines of the American Telephone and Telegraph Company.

The number of stations joined up with WEAF varies from night to night. There is no limit to the number possible to connect in a chain for the purpose of broadcasting. Sometimes the mother station through contract broadcasts a program exclusively. Sometimes only one or two out of town stations join her. On occasion she may broadcast a program under her own letters while a different program is being broadcast to her affiliated stations.

If a broadcast should prove of sufficient importance to interest more stations than are included in the present chain, arrangements could be made easily to include others. Lack of telephone wires between stations does not hamper a rebroadcast. Station 2LO, London, England, has broadcast a program which in turn was broadcast by American stations.

In considering the manner in which these multiple broadcast programs are effected, three possibilities arise. The program may be of national interest, one of the mother station's regular features, or a program which originates in her studios. The majority of programs broadcast originate in New York City. Should the source be out of town, long distance wires would bring the program to the transmitting station.

If a program takes places in a restaurant, theater, concert hall or auditorium, there must be some means of intercommunication between the station's control room and the source. To accomplish this three sets of wires are employed. One set effects a relay between the source and the station. Another is used for instructions from control room to operators stationed in the auditorium. A third set is used in case of emergency.

All wires intended to transmit musical programs must be so balanced and engineered that their range of audibility is such as to include the musical sounds of the program. Were this provision omitted, many of the musical tones would not be transmitted. Microphones placed throughout the auditorium at suitable intervals are connected to a control box which enables the operator to plug in and out on any particular instrument.

From the control box the program proceeds to an audio-amplifier where it is strengthened so as to enable it to be carried to the transmitter with the necessary input volume.

Monitors must constantly be on the alert while the program is being relayed from auditorium to transmitting station. Operators on the scene of action must listen in to ascertain if the program is being clearly received. Communication is thereby immediately established between control operators at the station and operators in the auditorium in case of difficulty.

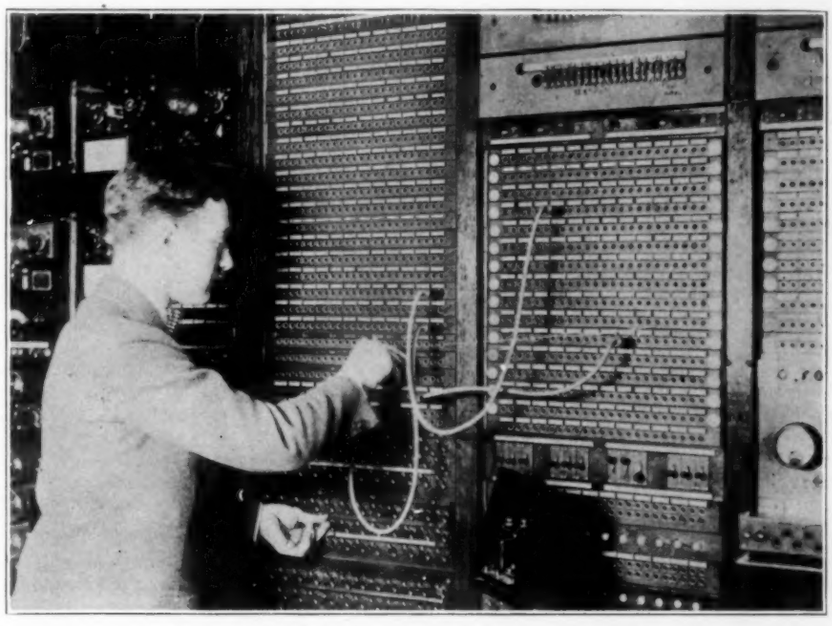
The essential difference between broadcasting an event of national importance and broadcasting a regular feature of the mother studio lies in the fact that in the latter case, much of the broadcasting apparatus is permanent. Station WEAF possesses a dozen sets of three-wire-pairs connecting auditoriums outside of the studio. These are ready for use at a moment's notice. All the preparation required to effect a connection is to slip a plug into the proper jack on the control board in the "speech input" control room of the stations.

Little preparatory work is needed on the part of station operators when the studio is broadcasting. Microphones are permanent fixtures, capable of being plugged in and out at will. From the point of view of a control-board operator it makes little difference, however, whether the program originates in the studio or outside. His task remains much the same. In either case he plugs his wire into the proper jack on the panel and maintains watch.

For outside sources which broadcast regularly there are a set of these jacks each labelled with the name of the theater, restaurant, music hall, or auditorium involved in the broadcasting proceedings, according to the established program. Should the operator desire to put the Capitol Grand orchestra on the air, he plugs into the jack designated with the name of the Capitol theater.

From the control panel, the wires enter amplifiers. There are seven of these attached to the WEAF transmitting station. Five of them are located on the left hand side of the "speech input" control panel, two on the right hand side. Three of those on the left are regularly used for the three studios of WEAF. The others are used for "lining up" outside events and in case of emergency.

Sometimes it is desirable to send out a program from the mother station to the chain of stations without involving the mother station herself. In this case the program, taking place in the station's studio, goes directly to the control board of the station through the amplifiers, and thence down to the long-distance telephone wires which stretch out over the

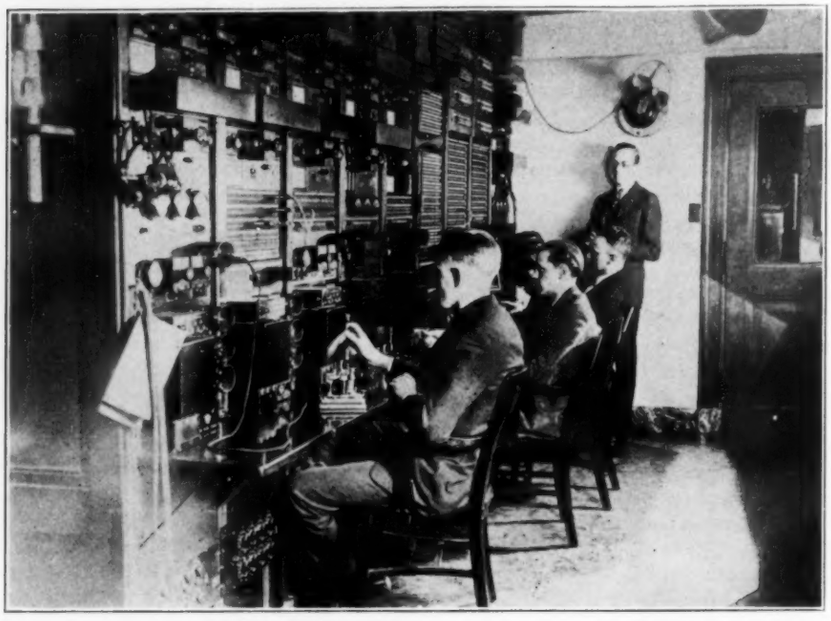


Gwilliams Service.

Outside studio points are brought into contact with WEAF on a panel board equipped with jacks designating the source of the program.

country from the terminal in Walker street.

The exclusive program which the mother station itself is transmitting at the same time goes from auditorium or studio, as the case may be, to the control panel in the station, is amplified and is then sent on to the transmitter at 463 West street where the actual broadcasting takes place. Thus it is possible to have two features on the air simultaneously from WEAF's studios: one a direct broadcast to listeners in its own territory, and the other an indirect broadcast to stations located over the country. A smaller control box designed to check in or out the various stations that comprise the chain enables the operator to add or detract from the number broadcasting indirectly at will.



G. Williams Service.

View of the "Speech Input" control board of station WEAF shows monitors ever on the alert.

T. H. Richford, Kellogg Branch Head, Dies at San Francisco

San Francisco, Cal.—T. H. Richford, manager of the San Francisco branch of the Kellogg Switchboard and Supply company, died suddenly here, October 11. For more than 20 years Mr. Richford had been with the Kellogg company, and served since October 1923 as branch manager at San Francisco. He was well known in the telephone industry and a host of good friends lament his passing. Mr. Richford was a brother-in-law of J. B. Edwards, president of the Kellogg organization.

Hominy to be Headquarters for Walton Properties

Hominy, Okla.—Headquarters of the Oklahoma Telephone company, the properties headed by J. W. Walton, will be moved here from Broken Arrow, according to a statement made here by W. O. Mills, local manager.

Lamesa, Tex.—State Telephone Co., Lubbock, has bought the local telephone company from J. H. Lee. C. W. Lee remains as manager.

New Hampshire Holds Annual Meeting

Concord, N. H.—John Gadd, general manager of the White Mountain Telephone Company, presided over an interesting convention of the 30 telephone companies in the state during which the problems confronting the telephone industry of that state were subjected to their annual general survey. The meeting was held here Sept. 16 and 17.

Among the featured speakers were J. G. Ihmsen, vice-president and general manager of the Up-State Telephone Association of New York, ex-governor Fred H. Brown, who now is a member of the New Hampshire Public Service Commission, and G. H. Mason of the New England T. and T. Company, who figured in the conference of plant managers and superintendents.

Eaton, O.—Eaton Telephone company plans building of a new headquarters building. E. G. Morgan is manager.

Ahoskie, N. C.—Carolina T. and T. company will spend $30,000 in improvements here.

S. S. Malolo Has Big Ship Installation

Philadelphia, Pa.—The contract for the entire telephone equipment of the S. S. Malolo, the largest and fastest high-powered passenger steamship ever built in the United States, has been placed with the Western Electric Co. The contract calls for one of the most complete marine telephone installations in the history of American shipbuilding.

Each of the 274 passenger staterooms will be equipped with a telephone, while a feature of the installation will be a phone in all of the staterooms occupied by the crew. A total of over 500 telephones, with a 340-line switchboard will be required. Communication with the shore while the vessel is in dock, will be maintained by trunk lines through terminal boxes equipped with line protectors and metal couplings for contact with shore cables.

Westinghouse Has New Battery Charger Catalog

Pittsburgh, Pa.—The Westinghouse Electric and Manufacturing company has released a new catalogue on Rectigon Battery Chargers. The catalogue is divided into sections that describe the application, operation and construction of telephone rectigon outfits, radio and private garage rectigon outfits, home and garage outfits, radio "B" battery charging attachments, the 6-ampere 75-volt rectigon outfit, and the 12-ampere 75-volt rectigon outfit.

These products are distributed to the telephone trade through many manufacturers and jobbers.

Middletown, N. Y. Gets October Up-State Meet

Middletown, N. Y.—A district meeting and traffic conference of the Up-State Telephone Association of New York will be held here Oct. 22 in the rooms of the local Chamber of Commerce.

St. Louis, Mo.—James R. Kearney corporation, manufacturers of overhead and underground utility equipment, 4224-32 Clayton avenue, has recently issued its first bulletin catalog. Bulletins contained in the catalog include those on anchors, guy wire clips, deadend eyes, and extension sleeve twisters. Additional bulletins on other specialties soon will be available.

Cuba, Ill., George Stumbaugh, Cuba, and Mrs. E. C. Jacobs, Massilon, O., have bought the local telephone company. Improvements are planned.

Politics, Promoters and Plant Bear Watching

By HENRY A. BARNHART*
President of Indiana Telephone Association

A famed philosopher once said: "We should count that day lost when we live all day in the rut of yesterday." And another one of distinguished achievements said: "Commit something, worth while, to memory every day; do some kindly act every day; and add to your knowledge and understanding every day."

Some of you may feel that it would be far fetched maneuvering to try to apply such fine philosophy to the common-place, work-a-day of those engaged in the telephone business; but if we are working with the objective of success in view any of the foregoing observations apply directly to our well being. The man or woman in the telephone business who has no ambition beyond getting in hours enough to "get by" on pay day is a barnacle on the industry and a drone in the productive and social spheres of life. They are more than that. They are an imposition on the public that supports their industry and they will never rise above the blighting sophistry that "the world owes me a living." Be you telephone owner, manager or employee, you are a detriment to yourself and to your chosen business when you refuse to try to add efficiency to your vocation or more useful qualification for yourself and your business. No one has ever risen above the mediocre—the commonplace in life—unless they gave the benefit of their observation and experience to their job and no one ever will, for we are ever surrounded by those ready and willing to step upward and onward past us if we are content to stand still.

"Go to the ant, thou sluggard, and be wise," and get on in the telephone business, thou time server, or get out. Our industry can not stand still. It must either progress or drift back. And our success or failure depends entirely upon our inclination to do or not to do. The darkey was exactly right when he said: "We is *is* or we is *isn't*."

Another thing of serious concern to everybody interested in public utility investments is the conduct or misconduct of some high up in the business. For some reason the public is more or less suspicious that it is being victimized by questionable collusion of utility owners and public officials. This is mostly follow up from other years when local officials were often involved in public utility scandals as a result of franchise and other manipulations. And now, just as we were growing into the good opinion of the public that our rate regulations are based on an honest showing in court and just decisions by those appointed and sworn to uphold the law of fairness between utility and public, a great political scandal, in a neighboring state, exposes our business again as an open target for the agitator. Developments in an investigation showed that a leading public utility man of the country (not a telephone man) contributed almost two hundred thousand dollars to the primary election campaigns of three candidates for United States senator—two of them representing one political party and the other an opposite party. But the evidence showed that the great bulk of this slush fund went to a candidate who is at the head of the rate making power of the state, while the small balance went to the other two candidates.

And what was the inference of the public and the press? Either that this high finance favor was for past considerations or future anticipations and, in either event, it was money that had been paid in to the utility by the public and now seemingly used as a bribe for official favors.

It ought to be gratifying to the telephone industry that it can truly say: "Shake not thy gory locks at me; I didn't do it." But that does not clear us from the censure that has been brought upon public utilities in general by this flagrant violation of the ethics of business integrity. It looks so much like corruption in high places that it ought to be denounced by every well meaning utility man in the country. While I am not binding any man or any activity by my opinion, I am fully convinced that our deserving business can not afford to tolerate that sort of thing in the ranks of fellow public utilities without frankly repudiating it, for it is a smirch upon the character of one utility which is sure to indirectly stain us all.

Our business is a vested right, it is as sacred to those dependent upon it as the law of self preservation, and the man who would blight it by scandal breeding conduct nullifies the fundamentals of business honor and the essential asset of public esteem and public confidence. He dishonors his own business and thereby brings reproach upon others of similar public relation. In the condensed language of Iago's protest to Othello: "Who steals my purse steals trash; but he who filches from me my good name, robs me of that which not enriches him and makes me poor indeed."

The Wild-Cat Peril

Ever since the close of the World War unrest and inclination of our people to do things in an emotional way have beset the even tenor and stability of business. We have had reckless real estate booms, chain bank booms, oil field booms, stock market booms and other wild finance nightmares that have put to test the pacifying genius of our foremost business stabilizers. People seem to have been attracted by, and stung by, wild-cat financing in this, and that until investors are leary of the questionable and plunge for the steadfast with stampede-like characteristics which threaten to unsettle the object of their financial enthusiasm, however safe and sound, it may be. And in these whirls of financing, telephone securities are now alluring to men of large means but of little or no telephone business experience. And this turn in favor of our securities, which experience and careful financing have placed in the A 1 ranks of American business, have attracted stock promotors and other speculators to our field until there are fears by telephone men of a sound judgment that this big stir to buy and sell telephone systems bodes no good for the continued reliability of the business. And to such extent has this threatening aspect grown that those of largest interests in the telephone industry were recently called in conference. Head officials of the American Telegraph & Telephone company and of the United States Independent Telephone association met and, after thorough and impartial consideration of the matter, adopted and ordered published the following resolution:

"RESOLVED, That it is distinctly detrimental to the interests of the telephone using and investing public, and to the industry as well, that telephone property which is for sale should pass into the hands of speculators or promoters who have no interest in the industry nor in the public service, but who are solely or primarily interested in the sale or exploitation of securities without re-

**Presidential address at 1926 convention of Indiana Telephone association.*

gard to the value of the property behind them or the necessary provisions to care for the upkeep and depreciation of the physical property which is so vitally essential to sound telephone financing, as well as in total disregard of the desirability of some assurance of community of practical telephone management."

This is timely warning from dependable and deliberate authority. It signals danger ahead for all of us. And it duly warns speculative capital that money invested in an enterprise that has been safely managed might be a hazardous risk in management of less experience and less personal interest.

Any man has the free, American right to sell his business if he wants to. And he also has the right to sell to whomever he pleases. But the telephone business is now a safe and a reasonably good business. It is a business which the public has helped to build up and from which it has a right to receive good service at fair rates. And telephone owners who disregard the merits of the public, which has helped them by substantial patronage, and turn their property over to adventurers for speculative purposes, are not obedient to their responsibility as heads of a semi-public enterprise on which the well being of communities must depend. Fellow telephone owners, if you feel that it is to your best interest to sell your property, that is your privilege, but you owe it to the business associates and patrons, that have helped you to what you are, to sell to trustworthy people or organizations who will carry on your good intentions of faithful service giving. In any event do not option your property with "binder boys" or speculators to peddle promiscuously. That course will surely invite demoralizing reproach upon the telephone business and cheapen your property and mine in the estimation of that great element of citizens whose good opinion is our largest going assets.

Likewise, kiting securities, manipulating valuations and charging fast living to expenses of telephone plant operation is a disgrace and blight on our business which our state officials are rightfully trying to prevent and in which efforts they should have the indorsement of every upright telephone man in Indiana.

If these observations seem extreme to some of you, responsibility therefore should be placed directly upon him who gives them utterances for, after careful investigation and consideration, he is convinced, without prejudice against any one, that the dangers ahead ought to be pointed out so plainly that the thoughtless or the wilful may see and realize.

Plant Disability Serious

There is another defect in our activities. It is plant disability rather than managerial delinquency. I note with much interest and hearty approval that some telephone managers in our state are active in the campaigns put on in various cities in behalf of better trade and social relations in their communities. Honesty, liberality, civic enthusiasm and advertising are all commendable and essential to telephone popularity and growth, but courtesy is the outstanding stimulant in establishing business success. True it is not always easy to be courteous, but even if we can not so be we can, in rare cases only, afford to be harsh or impolite to our customers and the public. Sometimes I think telephone managers ought to have backbone enough to occasionally throw a ruffian out who deems it his privilege to insult, with impunity, officials and employes of telephone companies and to bemean, at will, the operator who is trying faithfully to give him service. But, on second thought, it is clearly apparent that such righteous resentment would accomplish little in moving our business along toward larger popularity and success.

However, courtesy, or public spirit, or economic management, or team work in operating a telephone plant cannot, individually nor collectively, furnish good service. First of all we must have good traffic facilities if we may give good service and all the co-ordinate factors that operating tact and managerial efficiency can devise will do us little good if our poles and wires are tumble down, our switchboard a wreck and our telephones antiquated or worn out. I would that everybody financially interested in the telephone business in Indiana, and everywhere else for that matter, could and would read the contribution of Mr. D. H. Whitham entitled, "The Wrong in Our Toll Service," published in the July number of the Telephone Bulletin. It points out, in an impressive way, the real weakness of our business. Bad spots of apparatus for long distance purposes are too prevalent in our state and this here-and-there defect in long distance service giving, in a measure, contaminates it all with inefficiency. So, too, in local service giving. Poorly constructed and maintained telephone plants create so much criticism of poor service that it entangles with good service and vaudeville cracksters and funny page jokesters ridicule our industry as a whole and we all pay the penalty of adverse public opinion because of the too numerous dilapidated and mismanaged telephone systems giving service that creates and spreads public dissatisfaction. Isn't there some way by which this association and the public service commission can remedy this imposition on both the public and our business? Who is the man of the hour for this emergency?

But there is a bright side to our business. Co-ordination of effort for popular telephone service giving, in Indiana, was never so strong as it is today. And this upbuilding of cordial and substantial relations with the public augurs well for a fairer deal to our investment and a larger growth of our business.

How has this come about? First, by our personal efforts to be frank and honest with both the public and the officials in control of our business activities. Second, by the constant schooling we are giving to telephone people through the impressive medium of many meetings throughout the state wherein courses of practical instruction in the efficient conduct of our business are "hammered home" to manager, plant force, operators and officers alike. The six district associations have, within the year, each held several meetings and, in addition, numerous neighborhood conferences and picnics. And where we, in the early days of association endeavor, had a dozen operators and twice as many managers and officers present, we now usually have four times that number or more and misunderstandings with our neighbors are growing less and less frequent and popularity with our patrons more and more helpful.

This growing strength, in service giving and public good will, has reached a point where the condemnation that formerly was heaped upon us by politicians and demagogues is fading away and for the first time in years both leading political parties, in our state, met and adjourned without direct or indirect denunciation of our business. And our better understanding among ourselves as the result of frequent better business conferences and our efficiency strides into the good graces of the public have stabilized our industry until most of our bugbears are disappearing and our business constantly improving wherever we properly encourage it to do so.

We have an interesting business, a growing business and an honorable business by which we can render popular service and earn a modest and reasonably sure profit on money invested if we are alert, progressive and prudent. And keeping faith with the public, reading and heeding the wholesome contents of our telephone journals, attending meetings like this and keeping the merits of our business before the public through judicious advertising will give us a satisfying status in one of the most interesting and promising vocations in the world.

One thing more and I shall finish. Our success is not alone in our personal keeping. We must have able assistants, with our business at heart, if all goes well. The trouble shooter in his rounds, the construction force in the field and the operators at the switchboard dealing with the public every minute of the day can, by courtesy and concern, build up a good will invaluable to stockholders. And on

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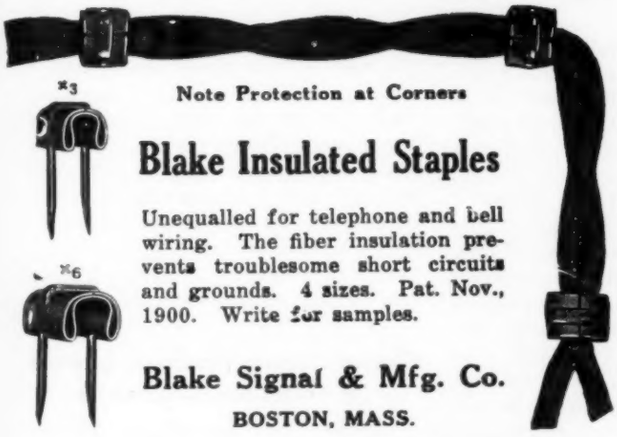

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Produced in our old reliable standard brands "Extra BB" "BB" and "Steel"

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Multiple and Single Interlocking CREOSOTED WOOD CONDUIT

Can be opened up and placed around cable
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For prices and particulars of Meredith's Single and Multiple Conduit

the other hand, by discourtesy and unconcern they can tear down a business despite the good intentions of the management. Let us treat our help like the fidelity they show is appreciated and we will thus build a bulwark for our industry which no other means could accomplish. Team work relations among employes, from manager to office boy, and courteous consideration of the public and its interests is the rock of ages on which any business may stand immune and manifestly self assured. The larger telephone organizations recognize this requisite for success and the smaller systems can do likewise with much improvement.

The opportunity for success is wide open before us, the law of just compensation is with us, the need for our service is imperative and permanent, and if we will play the game four square with efficiency and honor our days will be free from the uncertainty and lack of resource, which besets many other lines of endeavor, and we will be secure in our financial stability and situated advantageously to discharge our obligation of man's duty to man.

W. J. Dodge, California Commissioner, Joins Pacific T. & T.

San Francisco, Cal.—W. J. Dodge, who has been the telephone and telegraph engineer of the California Railroad Commission since April, 1923, resigned to become General Commercial Engineer for northern California for the Pacific T. and T. company. Arthur B. Fry has been made the successor to Mr. Dodge.

Mr. Fry graduated from Purdue University in 1896. Shortly thereafter he entered the employ of the Central Union Telephone Company, working through various stages of maintenance work until 1901, when he moved to Los Angeles, to engage in electrical contracting work with Mr. P. K. Higgins. In 1903 Mr. Higgins was appointed superintendent of equipment for the new Home T. and T. Company of Los Angeles, and he asked Mr. Fry to become his wire chief.

In 1904 Mr. Fry succeeded to the position held by Mr. Higgins and later, after a course of shop training in the factory of the Automatic Electric Company, became superintendent of equipment of the Home Telephone Company of Puget Sound, an automatic plant, which position he held until the company sold its plant to the Pacific company. Returning then to Los Angeles, Mr. Fry was employed in various capacities with the Southern California Telephone company until 1921, when he accepted a position with the railroad commission.

Death Takes Miss M. E. Jones, Coffey System Secretary

Indianapolis, Ind.—Miss M. E. Jones, secretary of the Coffey System and Audit Company, died here September 4. A combination of a nervous breakdown and an infection resulted fatally to this able and popular business woman. Prior to joining the Coffey organization in 1916 Miss Jones was bookkeeper for the Newark (Ohio) Telephone Company. She was

Miss M. E. Jones

well versed in public utility and federal income laws, and a close student of each detail affecting the business done by the Coffey System and Audit Company which she had practically managed for the last two years since the appointment of J. W. Coffey as receiver for the Southern Michigan Telephone Company. Miss Jones made audits and prepared rate cases for some of the larger Independent telephone companies and had installed the "Coffey System" for telephone companies in a dozen or more states. She attended many national and state conventions and always was one of the welcome attendants at these events. Her cheerfulness, ability and remarkable capacity for work inspired many sincere tributes.

Miss Jones is survived by her mother and two sisters.

European Work Continues to Extend Service

Paris, France—A considerable extension of telephone service in France, which involves the building of a number of new long distance lines between leading French cities, as well as a line between Paris and Madrid, is being paralleled by work in central and southern Europe. A new cable between Budapest, Hungary, and Prague, Czecho-Slovakia, is being installed, and a number of automatic exchanges recently have been completed in Germany.

Independent Vets Plan Big Sixth Meeting

Chicago, Ill.—Sixth annual meeting of the Independent Pioneer Telephone association will be held October 14, during the U. S. I. T. A. convention at Hotel Sherman, Chicago. During this convention the roster of the Independent veterans' organization has an opportunity to go over the 1,000 mark. Frank Knapp, president of the organization, J. K. Johnston, secretary-treasurer, and the entertainment committee are formulating a schedule for a session that will have its climax in the annual luncheon which is to be held at the Sherman during Pioneers' Day. To aid digestion the committee is booking a number of headline vaudeville features for performance after the waiters handle the shipment of empty dishes southbound.

The Pioneers' entertainment committee consists of George Rodormer, secretary, John Japp, secretary-treasurer, and Frank Eldridge, C. V. Dodge, C. W. Schafer, A. D. Boal and L. Q. Trumbull.

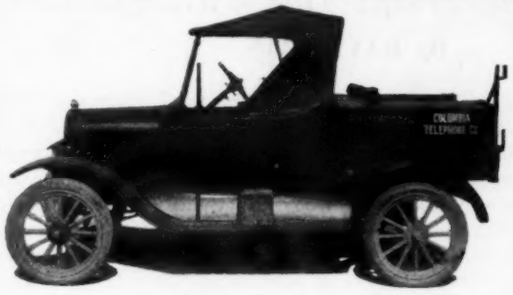
Missouri to Meet at Kansas City Nov. 17-18

Kansas City, Mo.—The annual convention of the Missouri Telephone Association will be held at the new President Hotel here Wednesday and Thursday, November 17th and 18th. Arrangements of the hotel are ideal for the convention and the preliminary work already done indicates that the coming convention will be the best that ever held, according to R. W. Hedrick, secretary of the association. An operators' conference will be held during the convention.

Florida Storm Damage Escaped by Telephone Companies

Atlanta, Ga.—Contrary to expectations, damage done by the recent Florida hurricane to telephone lines in the state was comparative light, according to a statement made by the local office of the Western Electric company. The only emergency equipment of consequence needed for repair of Bell lines was a five mile stretch of cable. Upon receipt of first news of the storm it was planned to handle Bell rush requirements of repair material from Chicago, but a check-up showed stocks held at the Atlanta warehouse sufficed.

Hysham, Neb.—John Otto, formerly of Bladen, Neb., has bought the local telephone company from John Middletown. Extensions are planned.



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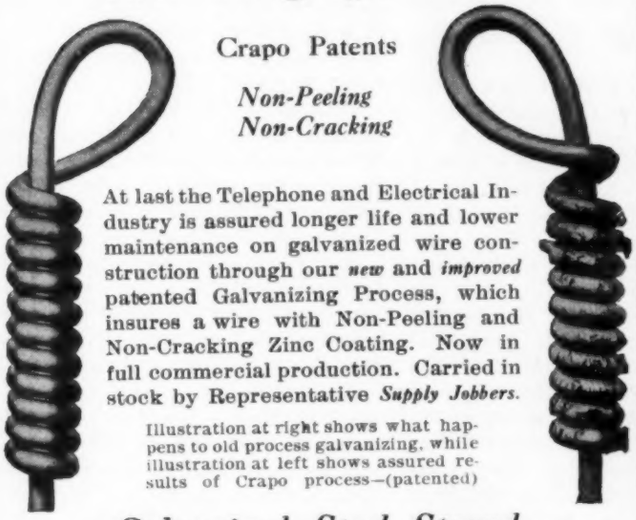

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Non-Peeling
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Illustration at right shows what happens to old process galvanizing, while illustration at left shows assured results of Crapo process—(patented)

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Standard or Commercial, Siemens-Martin, High Strength and Extra High Strength Grades

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Rosin Core

In the telephone field Kester Solder is the standard for both maintenance and production work. The comprehensive line of Kester Solder embraces a range of sizes from approximately 1/4″ to 1/16″ in diameter. Standard Acid Core diameter, being 1/8″ and standard Rosin Core diameter 3/32″. Packed on one, five, ten and twenty pound spools, there is a range of size and style of package suitable for every practical purpose.

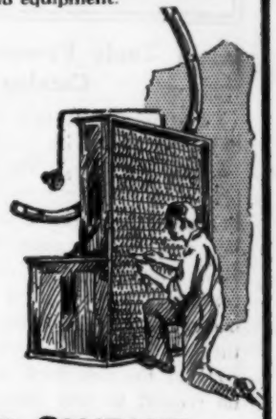
For heavier electrical work Kester Acid Core Solder can be used with considerable saving in time, labor and material.

For the more delicate electrical work on switchboards, etc., only Kester Rosin Core Solder should be used. Its pure rosin flux eliminates every danger of corroded work.

Most telephone companies specify Kester Rosin Core Solder No. 2, 50 core for line splicing as it not only conforms with the standard specifications, but also speeds up this class of work.

Kester Solder either rosin or acid core is handled practically everywhere by jobbers of telephone supplies and equipment.

We maintain a completely equipped research laboratory where we have solved soldering problems for many manufacturers. While our standard line of Kester Solder is adequate for practically every soldering job there are occasions where a specially developed solder and flux are required.



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6" 2-way	2,200 lbs.
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Klein Tools Presented in New Catalog

Chicago, Ill.—A new catalog, No. 26, has been issued by Mathias Klein and Sons of Chicago. The catalog shows several interesting new features of the line which has been in such high standing with linemen since its beginning in 1857. Illustrations of each item in the comprehensive line, and photographs of many of the tools in actual service, make the new book a good job pictorially. A copy of the new book will be sent free on request to any interested telephone man.

Palestine, Tex.—Two States Telephone Company will spend $25,000 improving local plant.

Agile Igorote Helps Build Jungle Lines

By RAY BLAIN

Fortunate indeed, is the telephone man who has the opportunity to broaden his knowledge by plying his trade for a few years in some foreign land. Doubly fortunate, is the one that comes to the Philippines, especially northern Luzon. I happened to be one of the fortunate few and had the opportunity of engineering some underground cable construction in the mountain provinces and to study at close range the Igorotes who inhabit this region. The genuineness of the native Igorote is very striking. He is usually a calm individual, extremely reserved, and loyal to his employer. Igorotes are generally of medium height, the average being between 60 and 65 inches. They are very muscular and full of chest.

Ex-Head-Hunters Now Linemen.

They are the best physical types in the Philippines. The men usually go bareheaded or wear small hats which resemble the American product without a brim, but are worn to cover only a small part of the head. They are fastened on by strings under the chin. Some years ago roasted canine was one of the favorite dishes of the Igorotes, and a dog market was maintained in Baguio. But the practice is gradually being discouraged and the market closed. A few of the old timers probably still enjoy their favorite dish, as it is not an uncommon sight to see an Igorote leading as many as twenty dogs by leashes strung with bamboo, ask him what he is doing with them and he will tell you they are watch dogs. I suspect that he is a "bootlegger."

A crew of these natives were employed to dig ditches for underground cable and were paid 40 centavos (20 cents U. S. currency) and three pounds of second grade rice each per day. To them this was a very good wage and above the average paid in that region. I had an American foreman that has resided in the islands for a number of years and who has acquired a knowledge of the various dialects of the lowlanders to which the Igorote dialect is similar and he was usually able to make them understand what he wanted. One night my foreman attended a "Fiesta" where native gin flowed freely and he did not arrive on the job at starting time the next morning. I got them all started to work, but due to the fact that they seemed to think I being some kind of a higher up was to be greatly feared, and as I did not know their lingo they usually did the opposite from what I wanted and did it with a vengeance.

One old hombre had his section of ditch completed to the required depth and I told him to quit and move on up the line. He seemed to think I wanted him to dig faster so he proceeded to dig himself in like a badger. The harder I tried to get him to understand that I wanted him to stop the harder he dug. I was at a loss what to do when the foreman, slightly recuperated, arrived and saved the day by saying "Esta mucho mabote spara," which means "This is very good, stop," or words to that effect. The foreman, due probably to the after effects of the fiesta, was in a very ill humor and proceeded to bawl them out by telling them that they were a lot of good-for-nothing bums and if they didn't hit the ball he would discharge all of them and get a good bunch of men. I do not know how much they understood but they all laughed like it was a very good joke.

These men did not know what it meant to shirk or to avoid the harder task. There were two especially husky men in the gang that we always used to break up pavements in crossing streets or surfaced roads. They would use a pick and shovel (they called them "pieko" and "pali") with all their might without ever resting an instant and would giggle like school girls all the time. I have never been able to account for the giggles.

Some of the men seemed very intelligent and after a few days learned the names of various tools and materials that we were using and took a keen delight in pronouncing them. They like to learn "Americano," and as one said "I can talk English but cannot speak it." I guess he meant that he could understand, but could not speak it. Another man spoke very good English, so one day I asked him his age he replied, "I do not know, sir, as my parents did not have my birth recorded, but from in-

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Double Pole Double Throw Battery Switches	.15
Generator Cranks for Independent Generators, assorted	.10
Common Battery Induction Coils	.15
Western Electric 2 M. F. Condensers, 4¾x8¾x⅝	.10
Repeating Coils, No. 37A, Large Type	1.50

Western Telephone Rebuilt Co.

3230 Chouteau Avenue ST. LOUIS, MO.

quiries I have made and from the ages of people with whom I played when we were children together I believe my age to be about 25 years." Further inquiries developed the fact that he attended night school regularly.

One little exchange used native male operators which were supervised by the American in charge and the service was very good. One day while in this office, the operator reported that the night bell did not ring. The American asked, "Does it not ring at all?" and he replied, "Oh, yes, on good-bye, but not on hello." What he was trying to say was that it rang O. K. on the supervisory signals but not on the line lamps. The operators have some very peculiar phrases which they have acquired, such as that 'phone is "shut," meaning busy, and that 'phone is "broke," meaning out of order.

Following are a few specimens of how they report trouble; figure them out for yourself.

"He cannot hear my voice."

"The voice is very small."

"Can hear the hearer, but the hearer cannot talk."

"Ring the bell but he will not talk."

"The 'phone can hear but will not talk."

One of the outside men was named Reli and the American called him "Relay," a very appropriate name for a telephone man. It reminded me of the days when I was referred to as "Long Distance," due to my being a strong six feet tall.

The night operator submitted a request for leave which is as follows, except that names are fictitious:

"Mr. D. G. Morgan, Manager.

"Sir:

"I almost have six years working at the switchboard night time and so I wisn to have fifteen days' vacation, as I am longing to see my oldfolk at Cabatatuan Pampanga. There is one man, my cousin, who is able to take my place during my absent. Please, sir, fix me up.

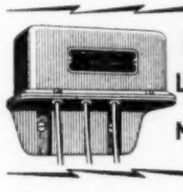
"Your Operator,

"NAGADOS VINCINTE.

"If any subjection to above please let the operator to call me up at the home I will drop myself at once in your office."

Needless to say he enjoyed the leave.

Williamsburg, Ia.—J. A. Walters of Toledo, Ia., has bought the Williamsburg Telephone Company. D. C. Phillips is the new manager.



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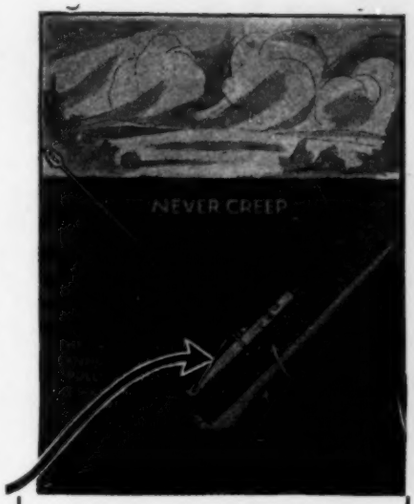

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BATTERIES (GG-2-10)

Primary Batteries

DRY CELLS. The dry cell is used almost exclusively at sub-stations and for private lines as well as for the rural and intercommunicating systems. In general, it can be considered as a cylindrical zinc can which forms the negative electrode and which contains the carbon positive electrode and the paste electrolyte. It must fulfill the following requirements for telephone service:

1. It must have a constant high voltage.
2. The resistance (internal) must be low.
3. It must be inexpensive.
4. Deterioration must be at a minimum when not in use.
5. Minimum standard voltage for three cells for long distance is 2.8 volts.
6. It must have a maximum duration of service measured to the "cut-off point," which is reached when the potential drops to 0.9 volts per cell.
7. It must be of convenient form.
8. It must be provided with convenient and low resistance connectors.
9. It must be clean and must not have leaks that will cause corrosion of the terminals nor cause unsightly accumulations of salts.
10. It must be of standard size to permit installation in limited spaces.

STANDARD SIZE OF CELLS. The greater majority of the dry cells used in telephony are of the No. 6 size, about 2.5 inches in diameter and 6 inches high. It may be either square or round, the round cells probably being the more common, although the square cells contain more active material for a given space occupied and hence have a correspondingly longer life.

CONSTRUCTION OF CELLS. The outer zinc can (negative electrode) has a thickness varying from No. 7 to No. 11 sheet zinc gauge. This can may be soldered, seamless or welded, the two latter classes being the most desirable, as the solder used in joining the edges of a soldered can cause small "local currents" which exhaust the cell when standing idle. The solder is electro-negative to the zinc. Much depends upon the purity of the zinc can and the nature of the impurities contained in the zinc, for any alloyed metal that sets up local currents reduces the life of the cell and hence the cost of maintenance. The inclusion of iron, copper or aluminum must be carefully guarded against.

The central carbon electrode forms the positive pole. This is a very compact form of carbon generally made from petroleum coke or similar pure carbonaceous material containing little sulphur. As the output is usually determined by the superficial area of the carbon rod presented to the action of the electrolyte, it is usually corrugated or roughened to extend this surface.

The dry cell is not actually "dry" but contains a paste or pulp of paper saturated with a solution of ammonium and zinc chlorides. The ammonium chloride is the active agent and is sometimes known as "sal-ammoniac" in its commercial grading. The moistened pulp is packed tightly between the zinc and the carbon electrode, forming the complete internal circuit of the cell. The conductivity or resistance depends much upon the physical condition of the pulp and the intimacy of the contact made by it with the electrodes. In most cells, manganese dioxide, a black granular substance, is used as the depolarizer and is of course packed in the pulp around the carbon electrode where it oxidizes the hydrogen gas liberated as fast as it is formed with the normal current output. To increase the conductivity of this portion of the packing it is usual to include graphite or fine carbon and mix it thoroughly with the manganese dioxide.

BATTERIES (GG-2-11)

Primary Batteries

ELECTRODES. The cathode of a dry battery is a compound element consisting of a mixture of manganese dioxide depolarizer and conductive carbon and graphite for reducing the resistance of the cell. The cathode is there much larger than the simple carbon rod because of the surrounding mass of carbon and graphite in the depolarizer. When the manganese dioxide is fresh it adds something to the conductivity of the cell, but during the progress of the discharge a part of the oxygen is lost so that it becomes reduced to Mn_2O_3 and then loses much of this conductivity. There is also some loss of manganese dioxide due to the local chemical action between the carbon and dioxide, as these two substances form a voltaic cell of very low voltage but of sufficient capacity to eventually decompose much of the depolarizing agent in the cell.

VOLTAGE AND CURRENT. The total voltage (E. M. F.) of the cell is equal to the sum of the electrode potentials, 0.56 volts for the zinc element and 1.0 volt for the carbon, manganese dioxide mixture. The total voltage is therefore 1.56 volts. When current is delivered to the external circuit this voltage falls off in proportion to the amount of current drawn, part of the drop being due to the internal resistance of the cell and part to polarization and several other minor reactions taking place within the electrolyte. If it were not for the manganese dioxide depolarizer, the voltage would drop off very rapidly because of the accumulation of hydrogen gas on the carbon element. However, as it is practically impossible in a commercial cell to gain perfect mixtures of the depolarizer and perfect distribution, the manganese dioxide does not perfectly depolarize the cell when the current flow exceeds a certain amount, and further, the depolarizing effect is greatly reduced as the cell grows older for the reason that the manganese dioxide gradually becomes exhausted.

The effectiveness of the manganese dioxide in suppressing polarization depends upon the intimacy of contact between the carbon and dioxide, its purity and its fineness and porosity. Porosity is of importance as it extends the effective reducing surface of the dioxide that is presented to the gas.

A typical No. 6 dry cell has a capacity in ampere hours that depends upon the rate of discharge; the faster the discharge the less will be its effective capacity. When short circuited and exhausted in one hour, the capacity will only be about 10 ampere hours. When discharged intermittently at a rate of less than 0 25 ampere over a period of many days the cell will be capable of delivering 30 ampere hours for a given drop in voltage. An average voltage of 1.0 volt drop can be expected of a good cell for a total discharge of 30 ampere hours under average service conditions. This is equivalent to 30 watt hours.

During service the life of the cell is affected by a gradually increasing internal resistance, partly due to the drying-out of the electrolyte and partly to the increasing zinc chloride content caused by the corrosion of the zinc. Double chloride salts are formed by the electrolytic action which enter the pores of the pulp and crowd out the effective electrolyte. Ammonia is liberated from the sal-ammoniac which forms zinc hydrate, a solid which clogs the cell and still further increases the resistance and the drop of potential.

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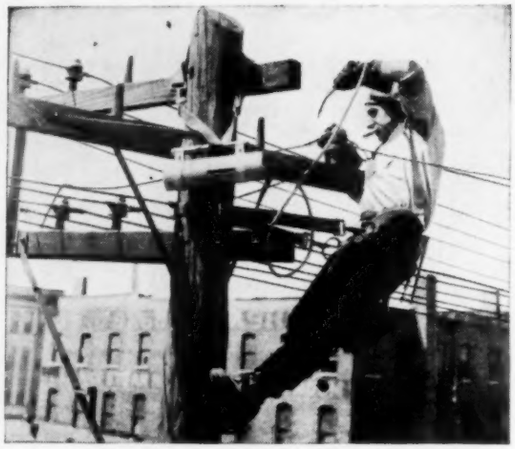

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Table of Contents

Editorial 19-20
Association Can End Cost Data Famine—Study Radio Legislation—A Cure for Guess-Work in Plant Accounting—Check Over Your Stock Before the Storm—Where Will It Stop.

Properties and Design of Electromagnets 21-25
By F. J. Dommerque.

Independents' Thirtieth Annual Meet Stirs Big Attendance. 26-31

MacKinnon Probes Gold Rush Perils for Independents 31-35

Picture of Public Regulation of Securities Is Shown 30-38
By Thorne A. Browne.

Line and Desk 39
Earth Borer Gets Results—Storage Batteries for Switchboard Transmitter Current Supply—Do You Have Tools Like This on Your Job?—No Need for Showshoes in the Philippines.

Sunny Says Public Will Pay for Better Service 40

Glandon Named to Lead Independent Pioneers at Annual Meeting 41

Equipment Features of Chicago Meeting Set a High Standard 42

Form New Manufacturing and Supply Company 45-48

Oklahoma Holds Rapid-Fire Series of Telephone Meetings. 48-50

Index to Advertisers

Addressograph Co. 53
American Electric Co., Inc. ..... 28 & 29
American Steel & Wire Co. 9
American Telephone & Telegraph Co. 32
Automatic Electric Co. ..... 1 and 55

Baker & Co. 51
Bell Lumber Co. 53
Berry & Co., L. M. 51
Blake Signal & Mfg. Co. 54
Block & Co., Lynton T. 51
Brach Mfg. Co., L. S. 51
Braden Co. 3
Buckeye Telephone & Supply Co. 43
Bernz Co. 54

Chance Co. 52
Chicago Solder Co. 47
Coffey System & Audit Co. 53
Contact Metals Co. 53
Cook Electric Co. 18
Copperweld Steel Co. 30

Electric Storage Battery Co. 54
Everstick Anchor Co. 43
French Battery Co. 14

Graybar Electric Co. 15
Gulf Cross Arm Co. 53

Herdrich & Boggs 53
Holtzer-Cabot Electric Co. 49
Hoover Body Co. 47
Hubbard and Co. 49

Indiana Steel & Wire Co. 47
International Creo. & Con. Co. 56

Johnson, J. K. 53

Kellogg Switchboard & Supply Co. ..... 4 & 5
Klein & Sons, Mathias 53

Matthews Corp., W. N. 12
Meredith, W. C. 54
Minnesota Electric Co. 53

National Cable Compound Co. 54
National Carbon Co. 11

Peiffer, P. 53
Potter Mfg. Co. 54
Premier Electric Co. 54
Prest-O-Lite Co. 10
C. F. Pease Co. 49

Rebuilt Electric Equipment Co. 53
Reliable Electric Co. 16
Runzel-Lenz Elec. Mfg. Co. 52

Seguin, J. J. 53
Standard Underground Cable Co. 54
Stewart Bros. 54
Stromberg-Carlson Tel. Mfg. Co. ..... 6 & 7
Suttle Equipment Co. 53

Templeton, Kenly & Co. 17
Texas Creosoting Co. 13

Unique Mfg. Co. 44
Universal Specialty Co. 53

Wall Mfg. Supply Co. 53
Warner Electric Co. 51
Western Electric Co. 8
Western Telephone Rebuilt Co. 44
White Company 2
Wray & Co., J. G. 53
West Mfg. Co. 44